FLIGHT

and The AIRCRAFT ENGINEER

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The Outlook

Air Defence

FLIGHT has always clung to its belief in air defence. In the inter-war years many writers cast scorn on such a theory, insisting that nothing could stop enemy bombers from hammering our cities at their will, and that our only possible form of defence was to hammer the enemy still harder until he desisted. Advocates of that theory usually contemplated that both sides would deliberately bomb the civilians on the other side, using gas and any other form of "frightfulness" at their disposal. They seemed to gloat in prospect at the idea of total war in all its barbarism, and waved aside all ideas that our air defences could do anything to check the enemy.

Well, we and other upholders of the validity of air defence never professed that *all* bombers could be excluded from this country, or from any other country; but, though at times we seemed to be a voice crying in the wilderness, we did not admit that air bombing unbacked by the victory of other arms would ever beat a virile nation to its knees, and we did believe that our Fighter Command would take a very heavy toll of the raiders, and so very seriously check the damage which they could do.

In the engagements of the last week the Fighter Command has most gloriously vindicated our belief in its powers. Of course, we had not foreseen that the Germans would possess the aerodromes on the French side of the Channel, and so would be able to send large escorts of fighters with every bombing raid. The fact that they have been able to do this has saved very large numbers of their bombers from destruction, and so has permitted the latter to get into position to drop their bombs. Had the bombers come without fighter escorts, or only escorted by more or less cumbrous long-range fighters, it is certain that the figures of German losses would have been much larger than they actually have been. It would not have merely meant that instead of shooting down, say, 30 fighters, we should have shot down 30 bombers. Unescorted bombers can be shot down much more quickly, and, therefore, in a given time one can destroy far more of them than one can destroy of the fighters. There must be few people now who would say that there is nothing in air defence.

Heavy Raids

THE Germans seem to be really in earnest, but exactly what they are earnest about is not so clear. They have been sending over formations of aeroplanes in increasing numbers, starting some fortnight ago with a mere hundred, and increasing to 400, 500, and 1,000 machines a day. These large-scale attacks have been coming by day, thus confirming the estimate that the Germans do not believe in night bombing as sufficiently accurate to give useful military results. Certainly their air crews have not had the training and practice in night flying which ours have had, for the leaflet raids were very useful in that respect if in no other. But daylight raiding, especially in a

KING CONGRATULATES FIGHTER SQUADRONS

The Secretary of State for Air has received the following message from His Majesty the King:—

"Please convey my warmest congratulations to the Fighter Squadrons who, in recent days, have been so heavily engaged in the defence of our country.

"I, like all their compatriots, have read with ever-increasing admiration the story of their daily victories. I wish them continued success and the best of luck."

15th August, 1940 GEORGE R.I.

cloudless sky, gives our Fighter Command something to bite on. The use that the fighter pilots have made of this opportunity is really staggering. Day by day the British public waits anxiously for the half-time scores and the close-of-play scores, as if Hutton were batting against Australia; and very disappointed is that public if a century is not scored. The first century produced rather delighted surprise, but now we have come to reckon on one as a right. On a dull day, when a mere 75 or so raiders are shot down, the public attitude is that "Jerry is bowling for safety, and won't give our bats a chance."

But, the serious student asks, what is Göring trying to do? The raids on Dover, Portsmouth, and Southampton can be understood, and so can the attacks on our aerodromes. But what profit do the Germans expect from bombing and machine-gunning suburbs? They can have no hope of beating this country to its knees by sheer terrorism, and the price which they pay in aeroplanes and air crews is high.

Naturally we expect more attacks, and probably still heavier ones, for some time to come, until it begins to dawn on the German High Command that the game is not worth the candle. In the meantime our fighter pilots are "not weary in well-doing."

Cheap and Nasty

A SUNDAY newspaper has caused some stir by publishing an article which alleges that a new scheme for supplying the R.A.F. with mass-produced aeroplanes of inferior performance "has the support of strong financial, industrial and political forces."

We are quite certain that in spite of the "strong financial, industrial and political support," any scheme which would in any degree lower the qualities of British military aircraft would very soon be doomed to failure.

That is not to say that something cannot be done to expedite production. In point of fact, many of the new types coming along now are particularly well suited to rapid production, without sacrificing any important military and service qualities. It is more difficult to do anything about the older types which have been in large-scale production for a long time.

Rationalisation

THERE are several ways in which aircraft production can be speeded-up. As we said in these columns a week or two ago, there is room for improvement in routine procedure; there is still too much paper work and too much of the "referred back to you" mentality about the relationship between the Air Ministry and the industry, although Lord Beaverbrook has done well in cutting through red tape.

In his article in this issue, Mr. F. G. Miles sets out the advantages of one system by which production can be speeded-up. Track line assembly is no new thing in itself, but it is only comparatively recently that orders have been on a scale which made its application to aircraft construction practicable. In fairness to other British firms it should be pointed out that track line assembly is in use at more than one factory, but the great interest in the Miles article lies in the fact that it argues the advantages of the system generally rather than describing the minute details of it as worked at the Philips and Powis factory.

ROYAL INTEREST. His Majesty the King inspects a searchlight during a recent visit to anti-aircraft posts in Kent.

WAR in the AIR

Enemy's Heavy Losses : London Suburbs Raided : Streets Machine-gunned : German Oil Plants Destroyed

APPARITIONS: Strange shapes are to be seen in our skies these days when A.A. gun fire puts up a barrage against balloon strafers.

IN our last issue we brought the story up to the heavy air fighting on Sunday, August 11. It will be remembered that Thursday, the 8th, saw the first mass air attack on Britain, when we shot down 61 enemy aircraft and lost 18 of our own machines, from which three of our pilots escaped safely. There was a lull on the Friday and Saturday, on each of which days we only destroyed one German machine, losing none of our own on the Friday and one on the Saturday. The Sunday, however, proved to be the first day of a continuous series of heavy attacks, sometimes by 500 German machines at once. On the Sunday we shot down altogether 65, on the Monday 62, and on the Tuesday 78. On the Wednesday the intensity of the attacks died away to a considerable degree, and we only destroyed 31 enemy aircraft (24 by fighters and 7 by fire from the ground). Our own losses during these days were: Sunday 26, of which two of the pilots were safe; Monday 13, of which one pilot was safe; Tuesday 13, of which 10 pilots were safe though three were wounded; Wednesday 7, but two of the pilots were safe. On Thursday, August 15, our total of victories passed the century for the first time, as we destroyed 180 German machines, losing 34 fighters, but 8 pilots survived. On Friday we bagged 75 and on Sunday over 140.

Fighters and Bombers

THE interesting point about these figures is the varying proportion of fighters and bombers which the Germans lost. On Sunday, the 11th, they lost 22 bombers and Me. Jaguars to 37 fighters. These figures do not include one seaplane shot down and six machines of unspecified type shot down by the fire of naval vessels. On that day it was obvious that the German fighters were engaging our defenders very hotly, and though they lost 37 fighters to our 26, they had evidently done something to protect their own bombers. On Monday, August 12, the figures do not tell quite so clear a story, as the Air Ministry communiqué has classed the Jaguars among the twin-engined fighters, perhaps because in the heat of combat our pilots could not always distinguish one sort of Me. 110 from another, though it would be more instructive if the Jaguars were classed among the bombers. However, it is certain that we destroyed 26 bombers of the Ju. 87 and Dornier types, as well as 11 Me. 110s. The proportion of bombers to fighters destroyed was growing. Tuesday, August 13, was a more satisfactory day, as we destroyed 64 bombers and fighter-bombers to 14 fighters, while we only lost three pilots killed and three wounded (13 machines lost). On that day the German fighters had conspicuously failed to protect the bombers in their charge and did us very little damage. In fact, for that day the tactics of the fighter escort broke down completely. We cannot explain why. All through this period the German losses were much heavier than ours, but compared with the numbers of German machines employed they were not anything like crippling, and they ought not to have been such as to spread alarm and despondency among the airmen of the German fighter squadrons. Yet we must conclude that on that day the enemy fighters did not engage our Hurricanes and Spitfires so closely as to keep them from wreaking something very like havoc among the various types of bomber which were sent against us. The object of the attacks on those days was to cripple a number of our ports, while as a secondary object several attacks were made on some of our aerodromes.

Attack on Portsmouth

ON the Monday morning proceedings opened with a raid off the Kent coast by 10 dive-bombers escorted by a dozen Me. 109s. This time the escort absorbed the attention of the fighters which went up to meet the raid and chased it all the way back to France. Six of the Messerschmitts were shot down. Three hours later 30 Ju. 87s escorted by about 50 Me. and He. fighters attacked shipping in the Channel. This time it was the dive-bombers which suffered most as six of them went down, accompanied by three of the fighters. One of the latter was a Heinkel 113, the latest type of German fighter to take part in the war. Then raid after raid appeared. One strongish force dropped bombs on the Isle of Wight, where a church and some houses were damaged. The biggest fight of the day took place over Portsmouth. The raiders consisted of Ju., He., and Do. machines escorted by fighters. One account says that about 200 machines started on this raid, but that

UNCIVIL AVIATION: The Germans claim that prosperity follows their occupation of territory. Here is Le Bourget on a busy day.

POOR FISH: The Italians have now started to sink the British Fleet twice weekly. The bad shooting shown in this picture makes us feel the Italian bomb "aimers" must have been agitated at the time.

when they were intercepted most of them turned back, leaving only about 50 to press the attack home. Rather heavy damage was done to private property and bombs caused a number of casualties, but military and naval objectives escaped. The nurses' quarters of a civilian hospital were set on fire but were evacuated without loss. A surgeon who was performing an operation went calmly on with his work until he had finished it. A railway station was bombed, a brewery was damaged, and a church was set on fire. But for this the enemy paid a heavy price. The A.A. guns, one of them manned by sailors, had their most successful day and shot down seven of the enemy. Our fighters were soon at work and accounted for 20 more. The day ended with a large-scale raid in the afternoon when 50 bombers appeared off the Kent coast with an enormous escort of 150 fighters. The latter were in formations of 30, and these formations were stepped up in layers to a height of nearly five miles. It must have been an imposing sight, but it did not overawe the British fighter pilots. They attacked and shot down 17 enemy machines. At one time during the day it was calculated that there must have been some 500 German aircraft in action. In fact, the day seemed something like the *Blitzkrieg* about which there have been so many prophecies. That night there was sporadic raiding over Wales, South-West and North-East England, in which a few civilians were killed.

Southampton's Turn

TUESDAY, August 13: Southampton had its turn of Nazi attention on the next day, while, of course, the South-East Coast and the Thames Estuary remained standing dishes. The Isle of Wight was visited again, bombs were dropped in Berkshire and Wiltshire, and several R.A.F. aerodromes were attacked. No doubt the Germans would feel much happier if they could cripple the Fighter Command by bombing our fighters in their stalls, but it is not easy to put an aerodrome out of action, as we found at Stavanger.

Once again the Germans are believed to have put 500 aircraft into the air in the day. Southampton proved no easy victim, any more than Portsmouth had done the day before. One Spitfire squadron bagged nine Ju. 87 dive-bombers and four Me. 109s. The same squadron had brought down seven enemy machines the day before, and on neither day did it lose a Spitfire or a pilot. The A.A. guns got three victims. One German was so imprudent as to fly on a straight and level course, which is what A.A. gunners pray for. Bits of the wreckage fell on the gun sight. In the Southampton area alone the enemy lost 22 machines. The city did not escape unscathed. Eight public houses were damaged, some severely, though in one only the windows were broken and the 400 drinking glasses escaped. A furniture depository was set on fire, but 100 people who were in a refuge below it escaped unhurt. One German airman who came down by parachute, wounded in both feet, was perhaps lucky that he landed in a tree. A farmhand climbed up the tree and tried to talk to the man until a party came who lowered the man to the ground by a rope. He had the Iron Cross in his pocket, and was allowed to keep it.

Another German who jumped with his parachute near a South-East town was not so lucky, as he fell into a pond and was drowned.

A Lull and a Storm

WEDNESDAY, August 14: By contrast with the previous day of Homeric battles, Wednesday seemed almost a quiet day. We only destroyed 31 enemy machines, of which seven were shot down by fire from the ground. We lost seven fighter aeroplanes, but the pilots of two were safe. One of the Germans was despatched by the Lewis gunner of a searchlight post, on which it was dive-bombing. Four other dive-bombers were shot down by A.A. guns from an aerodrome in Kent which they were attacking. Some men were killed on the aerodromes. The day's attacks included one on the barrage balloons at Dover, which very much annoy the Germans as they rule out dive-bombing, and a lightship was also bombed in accordance with the best Nazi traditions. There was only one mass raid, which took place soon after midday off the S.E. coast of Kent. It consisted of Ju. 87 dive-bombers, Jaguars, and Me. 109 fighters as escort. A patrol of seven Spitfires, all flown by sergeant pilots, tackled them and bagged several. Not far away, Hurricanes sent three more dive-bombers down in flames, and in less than an hour the coast of Kent was clear.

Late in the evening some Junkers 88 bombers flew over the West Country, but lost three of their number.

Thursday, August 15: After the comparative lull came a great day of storms, but it was the *Luftwaffe* which (in popular parlance) felt the draught. It is estimated that the Germans sent over 1,000 aeroplanes during the day, and so fulfilled the prophecies which various well-informed authorities have uttered during the weeks of comparative

WAR IN THE AIR (CONTINUED)

calm. The enemy attacked in strength at one point after another. The first was against aerodromes in Kent (the Germans are very anxious to minimise our fighter strength) and shipping in the Channel. A squadron of Hurricanes on patrol broke up the enemy's formation, so that only four Junkers dive-bombers reached the coast. About midday a very large force made an attempt on Tyneside, followed closely by another attack on Yorkshire. In each case our fighters caught the raiders and inflicted heavy casualties. In the Tyneside attack two squadrons, one of Hurricanes and the other of Spitfires, drove off the German escort when about ten miles off the coast. Some of the fighter squadrons stationed in the North of England had not been in a large action for some time and were full of eagerness to equal the records of the squadrons in the South-East. In the West a Hurricane squadron made a bag of 19, of which 14 were Me. 110s and the other five were Ju. 87 dive-bombers. This showed that the German escort was doing what it was meant to do. The last big attack of the day was a repetition of the first, namely, against South Coast harbours and aerodromes. One bomber, with a fighter escort, visited Croydon aerodrome and dropped bombs, which did a certain amount of damage and killed and injured a few people. Spitfires drove the raiders off. This raid caused the sirens to sound in London, but the all-clear signal went about a quarter of an hour later.

During the day one German bomber was caught by one of the aeroplane traps erected by the Ministry of Transport for the military authorities and was completely wrecked. All the crew were killed.

During the week the Germans have dropped a number of empty parachutes in different places in Great Britain, doubtless hoping that we should imagine that men had come down. In some of the parachutes papers were found which purported to be operation orders designed to mislead our military authorities. The ruse was a complete failure.

The Bomber Command's Offensive

THE British raiding of enemy targets on the Continent has gone on with more energy than ever, special attention being paid to oil plants and stores. Among the targets on which, unfortunately, we have to take action is Le Bourg in Guernsey, and it has been bombed several times. The Germans had congregated a number of aircraft there. On Monday, August 12, a Blenheim of the Coastal Command hit an ammunition dump on the quayside at Helder in Holland, and caused a tremendous explosion. Other Blenheims of the same squadron, co-operating with Swordfish and Albacores of the F.A.A., raided the harbour. Intense cold and ice-forming conditions greeted our bombers which flew over Germany on Monday, August 12. One of the objectives that night was the Gotha aircraft factory. On Tuesday, Northern France was the area chiefly harried, aerodromes at Cherbourg and Caen, as well as the seaplane base near Brest all being bombed. That night we made a heavy raid on the Junkers factory at Dessau, south-west of Berlin, and some 60 odd miles distant from the capital. Of course the Ruhr remains the principal objective, and here is a description of a raid on that district by a Flying Officer who took part.

"Our objective on this particular night was a synthetic oil plant in the Eastern Ruhr area. When we were being briefed for the show, we were told that this was a very important target and that every effort was to be made to locate and attack it. It wasn't too easy a target to find, as a matter of fact. They vary enormously in that way. On this raid, for instance, our alternative objective—that is to say the one we had to attack if we couldn't find the primary target—was very much easier. It was on the Rhine and situated on a bend in the river. Under normal conditions that would make things fairly simple. This oil plant was a different proposition. The land-marks which we were given for this were a wood and an autobahn. We were attacking independently, and set off from the base

The tale of a Skua : A column of smoke rising from a petrol store at Bergen, Norway, after being bombed by Skuas of the Fleet Air Arm.

at roughly two-minute intervals. Some of the other fellows were on different targets. Four of us in the squadron bombed the oil plant all within a period of 35 to 40 minutes, and we estimate that the numerous direct hits which we scored and the fires and explosions which broke out must have pretty well wrecked the greater part of the place.

"The first aircraft to attack bombed about 20 minutes after midnight. The second attacked round about a quarter to one. We came third a few minutes later, and the fourth aircraft followed us immediately. My navigator did a splendid job of work. We were absolutely dead right when we crossed the Dutch Coast going out, and we went absolutely straight into the target area. Much depends upon the navigator. It's their specialised job, and unless it's done properly the whole effort might be wasted. Going out there was a lot of searchlight activity, and there was a great deal of A.A. fire, as well as all the light stuff, though we were too high for them. Having arrived in the area we were groping, as it were, for the actual target for some time. We knew we were near it all right, but our instructions are very definite on this point—that we must identify the target without doubt before bombing, so we dropped parachute flares, but without success.

Bombing an Oil Plant

"THEN, about a minute or two later, while we were still searching, one of the other fellows from the squadron let off his flares about half a mile away on our port side. This other bomber was then about 2,000 feet above us. His flares went off below us, lighting up a wide area. They enabled my navigator first of all to spot the wood, which, as I said just now, was one of our chief landmarks. This led us on to the actual target. We now began our attack, then suddenly the bomb aimer reported 'There is another stick just burst across the target.' He told me afterwards that he had seen the whole line of them straddling the works. Members of this other crew when they got back said that the target appeared to be a mass of flames and explosions when they left. They had been the second on the job out of the four of us. The first aircraft had attacked from north to south and started fires, but apparently they had burnt out or had been got under control by the time the second bomber and ourselves arrived.

"When we saw our second aircraft attacking we turned away instead of continuing our run up. Our idea was to lay our bombs across the target at a different angle from

theirs so as to plaster it more thoroughly. They had bombed from north to south, so we cruised for a few minutes and then made our second run up. This time, of course, we were guided by the blaze on the ground. We attacked from east to west, and our bombs burst across the target almost at right-angles to the other's. Something new seemed to be catching alight almost every second. We had a Frenchman with us as a member of the crew, and he became quite enthusiastic about it. I don't speak French myself, but as far as I could make out he kept saying, 'Il est illuminé, il est illuminé.' All these Frenchmen are a very keen type. By now we had been in the area a good twenty-five minutes. All this time we were under fire. The aircraft got shaken about a bit, but we got away without being hit."

Striking at Italy

ITALY received a second visit from our long-range bombers on the night of August 13-14. The Caproni factory at Milan and the Fiat works at Turin were bombed.

Flying some sixteen hundred miles, the raiders made a double crossing of the Alps, and had to climb as much as three miles high to surmount the snow-capped peaks.

As they headed for home, after attacks which went on until the early hours of the morning, they left behind smashed factories, many of them on fire, and one pilot, as he recrossed the Alps, could still see the dull glare from the blazing Caproni works miles behind him. The Italian defences were apparently taken completely by surprise, and the anti-aircraft fire was scanty and ineffective. All the aircraft engaged on this flight returned safely except one which landed in the sea near our coast. The crew of this aircraft were, however, picked up and are safe.

In two months the R.A.F. of the Middle East Command have destroyed upwards of 170 Italian aircraft, losing only 18 machines themselves. The Italian casualty reports have admitted the loss of 76 pilots in July, which is more than we had claimed. In one recent fight over the Libyan desert a formation of Gladiators met more than double their own number of Italian fighters, and shot down 15 while only losing two themselves. The pilot of one of those machines afterwards turned up. The Squadron Leader who led the pilots said: "I took the squadron fifty miles beyond the Libyan frontier towards a place where we hoped we might fall in with Italian fighter patrols. We sighted a large formation of Cr. 42's with possibly some Cr. 32's among them. They failed to see us. This gave us a chance to manœuvre into position between them and their aerodrome so as to compel them to fight. It also allowed us to get into position between them and the sun, so the squadron approached unseen. As we got into range we opened fire. Our tactics were successful. They had not seen us, and were just 'sitting birds.' These were hit straight away and crashed to earth. The rest of the Italians then realised we were around. Perhaps they thought there were only three of us. Anyhow they came whirling around. Before the general *mêlée* began, however, we had a splendid target as seven of the enemy wheeled round and we sent two down. Our remaining flights quickly entered the battle, and in a few seconds the sky was a mass of weaving aeroplanes. At times they were only a few feet away from each other, and it seemed that they must touch. Soon there were six Italian planes burning furiously on the ground. One of our pilots counted five parachutists descending at the same time. My lads gradually picked off their own particular targets, and as we started to thin out the enemy the battle, which had been waged with thirty or forty machines bunched close together, became spread over an area some ten square miles and developed into a number of subsidiary actions.

"One of the Italian flights appeared to be trying to get away to their own aerodrome, but our last flight came in and headed them off, forcing them back into combat."

On Tuesday, August 13th, as the Italians were advancing along the coast road in Somaliland in their attack on Berbera, a Blenheim pointed out the concentration of troops to light naval forces, which promptly bombarded the Italians. The troops dispersed, and this held up the enemy advance for some time.

Later accounts of the great slaughter of German aircraft on Thursday, August 15, show that between 150 and 160 were shot down by our fighters, two by machines of the Coastal Command, 11 by anti-aircraft guns, one by a Lewis gunner of a searchlight post, and two by infantry fire. The total was 180. We lost 34 fighter machines, but the pilots of 17 are safe.

Friday, August 16, was, by comparison, a quiet day, as we only shot down 75 German machines. We lost 22 fighters, but the pilots of 14 are safe. At midday a large German formation approached the S.E. coast. Some got to the Thames estuary and dropped bombs on Tilbury and Northfleet, killing and wounding a number of civilians. Later the Isle of Wight and an R.A.F. aerodrome were attacked.

Just after midday the sirens sounded in London, but the attack was confined to a suburb in the South-West, where a station was hit and some private houses were destroyed. A few civilians were killed and wounded. There was another warning in London soon after 5 p.m. Londoners learnt with gratification that the raiders which attacked Croydon the day before had all been shot down.

Saturday, August 17, was even more quiet; in fact, the *Luftwaffe* seemed to be licking its wounds. In nine days it had lost over 550 fighters and bombers. So Britons enjoyed a perfect summer day.

The Leuna Oil Plant

ON *Sunday, August* 18, London had two warnings, one just after 1 p.m. and the other soon after 6 p.m. The Germans lost another 140 machines that day. Centuries were becoming every-day affairs for our defences.

Meantime our Bomber Command had been striking further heavy blows at Germany's oil supplies. The great I.G. Synthetic Oil Plant at Leuna, North-East of Leipzig, one of Germany's key production centres, was attacked in force by bombers for the first time on the night of Friday, August 16. The Leuna works normally produce 400,000 metric tons of oil a year, and its importance was indicated by the extensive and determined resistance of the ground defences. An intense barrage of fire from heavy and light anti-aircraft guns, supplemented by many pom-poms and machine guns, all working in co-operation with batteries of searchlights, met the attackers but failed to prevent them from making a methodical series of assaults. In some instances the ground defence held their fire until the raiders were directly over the target and caught in a cone of blinding searchlights. As one aircraft made its run up a fragment of shell penetrated the window and glanced off the navigator's harness, while other fragments pierced the tail boom and dented a wing. Another aircraft making its attack a few minutes later, had its tail plane, bomb doors and both sides of the fuselage damaged by pieces of shell; nevertheless, the pilot managed to drop his bombs to such effect that they caused the collapse of one of the high smoke stacks of the factory. Oil storage tanks were left ablaze and pilots saw their bombs fall on the compressors. By the time the attack had been in progress for an hour hundreds of bombs had been dropped and almost the whole of the two thousand yards along which the main plant extends was marked by a chain of fires, from which columns of dense smoke were pouring. Two instances of the extreme care which the R.A.F. take to identify their targets and thus avoid all danger of bombing non-military areas are made plain in the reports of pilots who failed to find Leuna. One cruised about in the neighbourhood from twelve-thirty until one-forty, then turned for home. On the way back, however, he encountered opposition from a large A.A. battery and reduced its fire with a well-directed salvo. Another pilot, who sought Leuna in vain for an hour, brought his bombs back.

A *Flight* artist's impression of the Ca 312 I.S. dropping its torpedo.

A MULTI-PURPOSE ITALIAN

The Caproni—Ca 311 : Ca 312 I.S. : Ca 312 bis

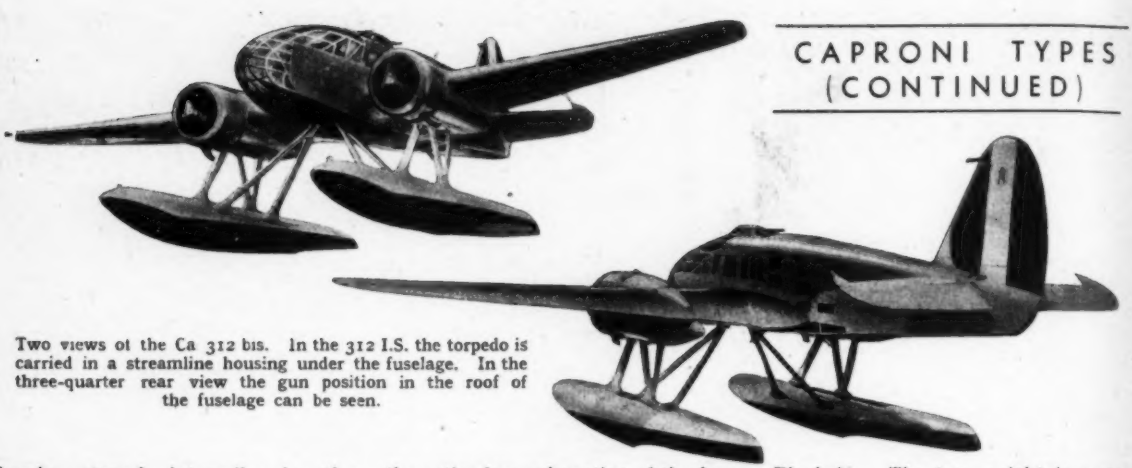
ONE of the oldest Italian aircraft firms, if not actually the oldest, is the Caproni concern of Milan, whose president, Gianni Caproni, was one of Italy's pioneer designers and constructors. Of recent years the concern has expanded to take in others, and the Caproni group is now a very large one. The parent firm, Societa Italiana Caproni, has its headquarters in Milan, and it was the Milan factory which was bombed by the R.A.F. last week.

A considerable number of aircraft types are produced by Caproni, not to mention the Isotta-Fraschini engines of the group of which Gianni Caproni is president. For the present we propose to confine ourselves to a description of a recent and very versatile type, known under at least three different guises. All three, incidentally, are powered by Piaggio engines.

Fundamentally, the airframe is identical in all three types, two of the changes being rung by fitting either a wheel undercarriage or a twin-float gear. The third change is concerned with the nature of the military load.

In its landplane form the machine is known as the type Ca 311, and is intended for reconnaissance and light bombing. The two seaplane versions are identified by the type numbers Ca 312 I.S. and Ca 312 bis respectively. The letters "I.S.," it might be explained, are the initial letters of "idro silurante" (hydro torpedo), and indicate that this type is a torpedo-plane. This is the type shown in the large *Flight* copyright drawing above. The type Ca 312 bis is identical in every respect with this machine, but, instead of the torpedo, it carries two

CAPRONI TYPES (CONTINUED)



Two views of the Ca 312 bis. In the 312 I.S. the torpedo is carried in a streamline housing under the fuselage. In the three-quarter rear view the gun position in the roof of the fuselage can be seen.

bombs stowed internally in the fuselage. Defensive armament in both versions comprises two machine guns, one in the port wing and the other in a turret on top of the fuselage. The latter gun is intended to cover the whole upper hemisphere.

The aerodynamic design is straightforward and conforms to the usual formula. In the landplane version the wheels retract into the engine nacelles. The seaplane has two long floats, supported on the usual structure of streamline steel tube struts. Each float is carried on "N" struts from the engine nacelle structure and braced laterally by inverted-vee struts from the fuselage. The floats are of light-metal construction and are of ample length. They are said to have a capacity of 5 cu. m. each, which gives, with a gross weight of 5,700 kg. (12,500 lb.), a reserve buoyancy of 88 per cent.

Mixed Construction

Structurally, the Ca 112 is of mixed construction, with wooden wing and chrome molybdenum welded tubular fuselage. With mixed construction it is obviously not possible to make the wing centre-section integral with the fuselage, and consequently it is attached by bolts. The fuselage itself is in two units, bolted together. It is claimed that by so designing the machine the manufacture of the various units can be carried out by different firms, provided the jigs used are sufficiently accurate to ensure the proper mating of the bolted joints.

In order to give the pilot and, particularly, the bomb-aimer a good view, the entire forward portion of the fuselage is covered with transparent material over a framework of steel angles and tees. To give the bomb-aimer a chance of escape by parachute, the nose portion can be opened, although one doubts whether it would always be possible to get clear of floats, struts, and revolving airscrews. For the use of the pilot in emergency there are two detachable panels in the cabin roof. Dual controls are fitted, there being two rudder bars, of which the starboard one can be folded when not in use. The wheel is of the swing-over type.

The equipment is planned with a view to using the machine for a variety of duties. Two-way wireless is carried, and there is full night-flying equipment, including a 1,000 candle-power landing light. A photographic camera is part of the equipment.

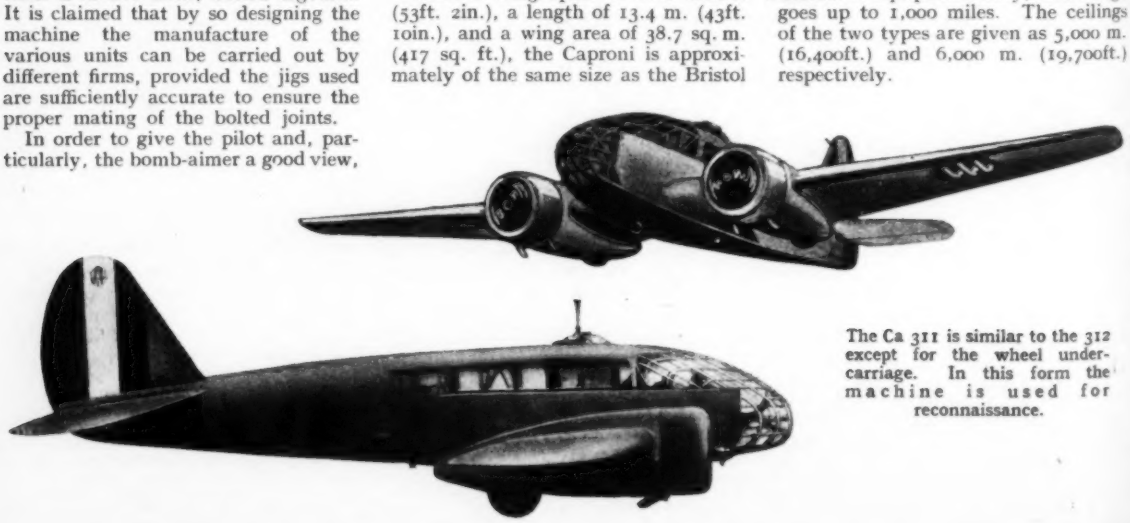
As already stated, all three versions of the machine are powered by two Piaggio engines. These are of the P.XVI type, a nine-cylinder radial of 42.9 litres capacity. The rated power is 650 b.h.p. at 3,500 m. (11,500ft.), with about 700 b.h.p. for the take-off. The engine speed at rated power is 2,200 r.p.m., and the airscrew reduction gear ratio 1 : 1.61. Variable-pitch three-bladed airscrews are fitted.

With a wing span of 16.2 metres (53ft. 2in.), a length of 13.4 m. (43ft. 10in.), and a wing area of 38.7 sq. m. (417 sq. ft.), the Caproni is approximately of the same size as the Bristol Blenheim. The tare weight is 4,000 kg. (8,800 lb.) and the disposable load 3,740 lb. in the case of the torpedo-carrying version and 3,520 lb. for the bomber.

Performance

In view of the lower power of the Piaggio engines, it was not to be expected that the Caproni could be as fast as the Blenheim, particularly when fitted with floats. Nevertheless, the makers claim for it a maximum speed at 4,000 m. (13,100ft.) of 400 km./h. (249 m.p.h.) for the bomber and 380 km./h. (236 m.p.h.) for the torpedo-plane. The wing loading is fairly high (about 30 lb./sq. ft.), but for all that it seems rather doubtful that the speeds claimed can be attained in practice.

The rate of climb claimed is good, 13,100ft. in 16 minutes for the torpedoplane and in 13 minutes for the bomber. No performance figures are available for the reconnaissance landplane version, but obviously they should be considerably better than those of the seaplanes. With full military load the range of the 312 I.S. is stated to be 600 km. (373 miles) and that of the 312 bis 900 km. (560 miles). If, however, the machines are used purely for reconnaissance, and carry defensive equipment only, the range goes up to 1,000 miles. The ceilings of the two types are given as 5,000 m. (16,400ft.) and 6,000 m. (19,700ft.) respectively.



The Ca 311 is similar to the 312 except for the wheel undercarriage. In this form the machine is used for reconnaissance.

The U.S. Army Air Corps' latest big bomber, the Consolidated XB-24, in flight over San Diego, California. The aeroplane is liberally supplied with hatches and windows. Fixed wing-tip slots and two pitot heads may be noticed, and the airscrews are Hamilton Hydromatics.

CONSOLIDATED BOMBER XB-24

Davis Aerofoil Again Used : Patent Details

THE U.S. Army Air Corps' latest "bombardment" (long-range bomber) type, known to the Air Corps as the XB-24 and to its designers as Model 32, has a wing incorporating the new Davis aerofoil. Designed and built by the Consolidated Aircraft Corporation, the prototype made its initial flight early this year at Lindbergh Field, San Diego, California.

It is a four-engined high-wing bomber of all-metal construction. The wing is a full cantilever type of high aspect ratio with four tractor engine nacelles mounted flush to the upper surface. Fowler flaps extend from fuselage to ailerons. In the illustration five fixed slots will be noticed in each wingtip.

Power is provided by four Pratt & Whitney 18-cylinder twin-row radial air-cooled engines rated at 1,200 h.p. each. The airscrews are of the Hamilton Standard 3-bladed Hydromatic constant-speed type, 12ft. in diameter.

The gross weight of the aeroplane is 40,000 lb.; wing span, 110ft.; length of fuselage, 64ft.; and overall height, 19ft. Crew varies from 6 to 9 persons, depending upon the mission to be performed.

Control surfaces are fabric-covered and mass-balanced. A full cantilever horizontal tailplane has twin fins and rudders mounted at the tips. The all-metal stressed-skin fuselage is equipped with hatches and windows in the nose, tail, sides, top and bottom. The landing gear is of nose-wheel type with all three wheels retracting.

The makers claim a speed of over 300 m.p.h., a range of 3,000 miles, and a bomb carrying capacity of 4 tons.

The Davis aerofoil has come in for a certain amount of publicity and some extravagant stories have been written about it. But the fact that Consolidated, always in the forefront of American design, has seen fit to adopt it and use it on their outstanding twin-engined Model 31 flying boat and then on the later XB-24, shows that it is somewhat more efficient than a flat plate.

The Davis Aerofoil

This aerofoil is covered by U.S. Patent No. 1,942,688, dated January 9, 1934. Its inventor lodged the claim some years before this, in 1931. The following is a brief precis of the patent:—

For any given upper curve of an aerofoil there is but one most efficient lower complementary curve. The upper and lower curves of the profile each affect the fluid flow around the other and are interdependent.

The general object of the invention is to provide a formula for laying out the two profile lines so that they have a definite relationship for each given type of aerofoil.

(*Continued on page* 152.)

TRACK ASSEMBLY

Line System in Use at the Works of Phillips and Powis

By F. G. MILES

WHENEVER a large number of similar mechanisms, each consisting of a number of component parts, are built, recourse is usually had to a moving line system of assembly. I believe Henry Ford started the idea in the very early days of the Ford car; he put the principles in actual practice by connecting the line of part-assembled cars together with pieces of rope so that the whole line had to move together. There is no doubt that this start over his rivals, which the success of this system gave him, laid the foundation of his present enormous business.

When he forced these revolutionary changes into his factory he did so against advice and prejudice, and it was only by the loyalty of his colleagues that he was able to justify his new theories. In a shop not his own, I feel certain he would have failed.

There are now few quantity-producing businesses in the world which do not base their production on flow assembly, and so far as the aircraft industry is concerned, America has taken the lead and started moving lines in various factories.

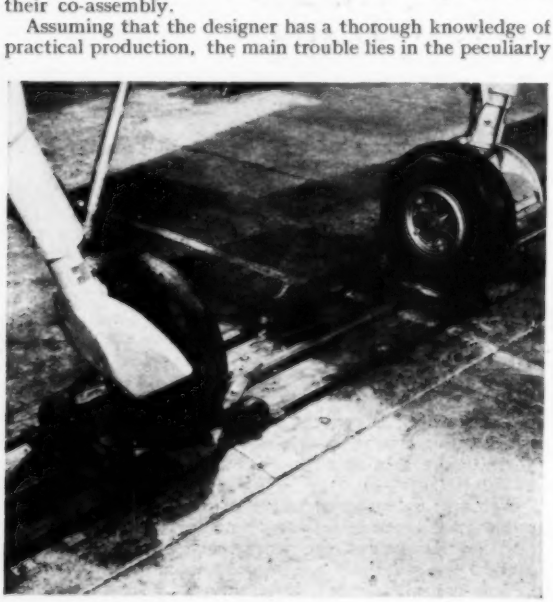
Some years ago, when the total quantities of one type of aeroplane were small, there was reason for not attempting such an innovation, but to-day the whole situation has changed.

An increasing flow of aeroplanes is required, and one type is established for a considerable period. There is nothing to prevent the adoption of stage-flow assembly except prejudice or unwillingness to meet and overcome the particular difficulties associated with such a complicated thing as an aeroplane.

Designing for Flow Production

In general, the principle of design for flow production is to arrange for large and small components to be built as units and to provide for a minimum of complication in their co-assembly.

Assuming that the designer has a thorough knowledge of practical production, the main trouble lies in the peculiarly difficult circumstances in which military aeroplanes have to be designed for production. As with commercial aeroplanes, aerodynamic knowledge does not stand still. On commercial aeroplanes, however, requirements are more stable and are governed by relatively few factors; it is possible, therefore, to look forward over a reasonable period.

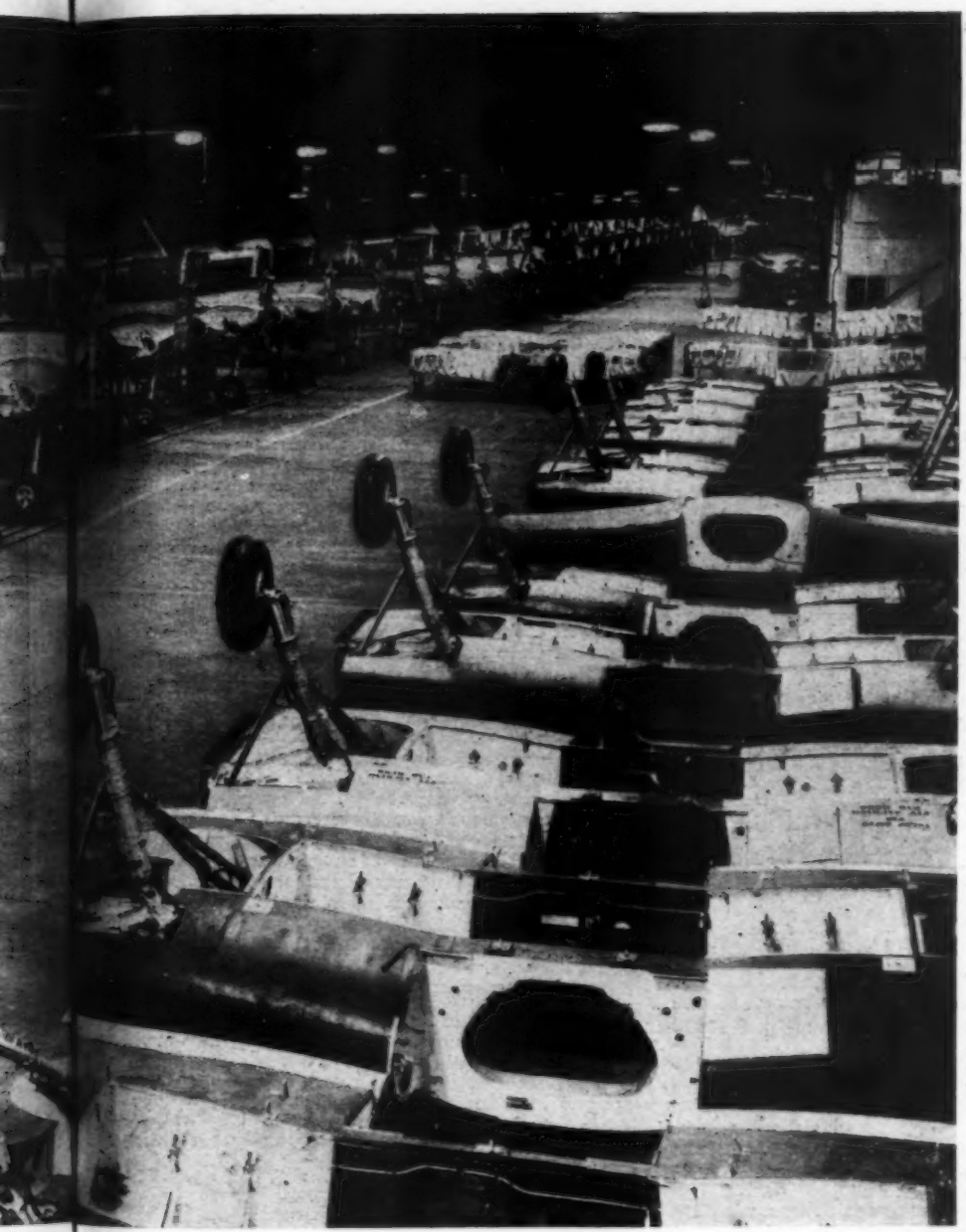


To maintain an even spacing between aircraft the trolleys are linked up by rods.

Military matters, on the other hand, are always changing. Armaments, duties, speeds, ranges have no constancy. New applications of radio, etc., and new arrangements of existing equipment are continually called for by their respective departments.

Consequently, the prototype aircraft has little or no relation to the production aircraft, and the design department finds itself, at the very moment it considers its work finished, with a completely new type of aircraft to build—*at the same time as the works are shouting for drawings to build jigs, tools and aircraft.*

During the period of production, the mock-up is held at the disposal of a great many different people and departments from the Air Ministry. It is necessarily made the



Centre-sections ready for transfer to assembly line opposite.

vehicle of hundreds of last-minute changes. In fact, until the first production aircraft has flown away there is no certainty in design at all. So there is some excuse if the various components designed so carefully as interchangeable units do not maintain the pristine separations we planned.

No Development Period

Even when the design is complete and the first aeroplane has flown, there is no true development period because the production of components has by that time reached a very advanced stage. They were begun many months ahead of the production delivery date, and only desperate reasons could justify a change.

Nevertheless, the firm as a whole does its best, and so do the sub-contractors who supply proprietary units. With these, even, troubles sometimes arise, and the beautifully simple layout provided in the early stages does not always work. It is not an unknown occurrence that an admirably simple unit supplied for the prototype aircraft, perhaps with a single quick-release connection which was to have held items "A" and "B" together, had to be changed on production — due to troubles that have arisen in the meantime—to about a dozen rods and levers.

Each time such a change occurs all the drawings over which the Design Department has been burning midnight oil, and all the jigs, tools, patterns, etc., which the shops are endeavouring to build while production is going on, have to be altered.

In addition to having to design the aeroplane, build the factory, design and make jigs and tools and to reach heavy production in one year—on an aeroplane for which the final particulars and specification have not arrived—one is also expected to reach complete interchangeability from the word "go!" Yet interchangeability can only be obtained by having drawings, tools and product alike, and we have none in the early stages of production.

It seems to me that a year of development would be necessary to provide a reasonable chance of obtaining such interchangeability without adverse effect on the design of the aeroplane.

Nevertheless, we design the aeroplane for production, and by some miracle it turns out to be much nearer to our early conception than we had dared to hope.

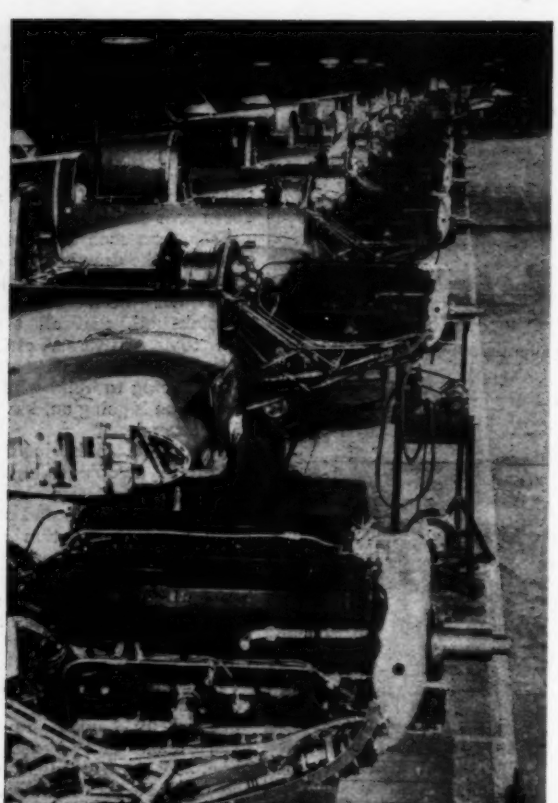
Track Assembly

All striving towards efficiency in manufacture reduces itself into a movement towards order, discipline and team work. Unorganised group assembly, held together only by the individual's knowledge of the job as a whole, must eventually give way to a planned system.

Planning in embryo starts with an attempt to provide the men with materials and jobs as they ask for them. Later, the work is organised into departments dealing with the various sub-assemblies.

Usually, at the present time, a stationary group or line of aircraft in the final assembly stage is arranged, and groups of men move round carrying out their more or less specialised jobs to their foremen's instructions. The weakness of this system lies in the difficulty in enforcing discipline and in the lack of accurate knowledge of what is going on.

It is very difficult to plan work accurately, because as soon as men of a group cease on their own job (either because they have finished all the aircraft waiting or because of shortages) the foreman finds them another job rather than put them on waiting time. Very often the work found is neither urgent nor important, and a feeling of slackness is established.



Installation of Rolls-Royce engines. At the far end the line goes round the corner to where wings are fitted.

An advantage of track line assembly comes from the inexorable warning it gives of shortage or assembly troubles, if discipline is strong enough. If the whole line is forced to stop because work cannot be completed, the system gives a warning that, by its seriousness, is bound to reach the top.

One of the faults of the normal type of group assembly lies in the fact that no job need ever be finished until the last possible moment, because the men can be taken from work held up by shortages and moved to another job. The shortage is (or should be) reported, of course, and action of some sort taken, but desperate action is often not initiated directly the shortage is known.

It is difficult, too, to impress upon those responsible the true urgency attached to any shortage of material; so long as the men have some work to do it may seem that time is not being wasted. Only when the aircraft is nearly due to fly do the accumulated shortages appear frightening, and then attention tends to be focused exclusively at the end of the job.

Mohammet and the Mountain

The simple step of moving the work past the men instead of the men past the work can effect a vast improvement in system. One of the most important things it does is to make discipline possible. Consequently, it is very necessary for the Planning Engineer to devise safeguards and warnings to protect that discipline.

When the final assembly line begins to move it will be found that there is a tendency to pull the details through the factory at the rate they are required. This allows for easy balancing-up of supplies.

The old method of pushing out orders in groups and batches, and then working like niggers to ensure that enough of them arrive in the later shops in time, is really much more difficult. They are inclined to arrive either

TRACK ASSEMBLY (CONTINUED)

in floods or trickles; in anything but an even flow.

An attempt has been made to indicate the belief that progress in manufacture develops from the throwing of a mass of more or less unplanned orders into the factory, where they are left to the men and foremen to sort out into order by themselves, towards the ideal state where every particle of matter is dealt with to a strict plan, and every operation is timed and thought out beforehand.

When planned, the factory is split up into divisions capable of dealing efficiently with the different types of sub-assemblies. The ideal is that these sub-assemblies should flow evenly from their own shops at a predetermined rate, along lines of communication which are short, unstagnant and clearly defined.

These lines should not be interrupted by stores or paper work more than is absolutely necessary. The parts should arrive at their predetermined positions in the shop at the times planned. The given group of men should then carry out an exact sequence of operations on them within the time allowed before they pass on.

The parts, raw materials and tools must flow or be available at the right moment; if they are not, a warning system should acquaint not only the people responsible for the failure, but every person interested—up to the managing director, if necessary.

As with the assemblies, the sub-assemblies must be confined to a given order of progress by tracks, moving belts or other methods throughout the factory.

We of Phillips and Powis believe that we are the first really to establish a mechanically-moved track assembly line system for the quantity production of aircraft.

In the case of the final erection of the Miles Master, a track, similar to a tramway line, is laid flush with the floor, and small carriages, on to which the aeroplane wheels are fastened, run on the rails. The carriages are coupled together so that the aircraft are evenly spaced down the shop.

When a stage is finished, an electric warning system provides the necessary indication, and an electrically-driven winch pulls the whole line down the shop into the next stage in a few feconds. Later on it may be possible to attain to a constant flow for output should quantity justify such a step.

Initiating a New System

The change-over to the track line assembly places heavy burdens on the Planning and Rate-fixing Departments. An ideal sequence of operations is prepared, and these are arranged into a series of stages, each calculated for a small group of men to complete in an equal period.

The fuselages are maintained in a horizontal position by having the tail wheels running in a raised rail or trough.

TRACK ASSEMBLY (CONTINUED)

Every operation, however small, must be considered. The work for each stage must be most carefully balanced and so arranged that the operatives do not get in each other's way. At the same time, as much work as possible must be catered for at each stage, because an unnecessary position means a waste of valuable shop space.

To give an imaginary example—an aircraft requiring 1,000 man-hours for its final assembly, and required at the rate of, say, 10 per week of 48 hours, might have its final assembly line split up into 50 stages, each occupied by two to five men.

The work would be carefully distributed to take each man about four hours as soon as he has settled down to the job. He would do exactly the same work in the same manner on each aircraft twice a day. Consequently, his efficiency should be found to grow throughout the term of any contract likely to be placed for one type of aircraft. That is, provided the co-operation of men and management is obtained to the full.

The main difficulty likely to arise is that of the line speeding-up beyond the hard-pressed sub-contractors' powers of supply. Good planning, however, should not permit a wide variation from the planned output, but should try to ensure a steady improvement.

It is better to reduce man-hours temporarily rather than to exhaust stores and supplies by producing beyond plans. Otherwise there is a serious risk of a stoppage after a few weeks.

Planning must be prepared constantly to re-balance output and, although it can be flexible to a certain degree, it cannot allow one or another department to run ahead of or lag behind the rest. If it should become necessary to reduce man power, an elementary point of social justice arises; the management must co-operate with and study the employee if they expect to get any real advantage from any planned system.

It is not human nature to work oneself out of a job. Ideally, the line must not be slowed up by removing operatives for less important work, or by discharging them.

Man power should only be taken from the line for a similar or a better job, unless these is inefficiency, bad workmanship, or some such reason.

It is not intended here to go into the morals or details of incentive payment, but it is obvious that the payment for the form of assembly described cannot reasonably be straight piece-work because the management set the standard for an operation from time to time and should be free to improve the working conditions or supply new aims.

However, it is important to shorten the stage times as the men become more skilled, and there is no doubt that an ample reward is justified.

Once the track is laid, the work planned, the pre-selection stores loaded and the starting gun fired, the onus passes to the chief production engineer, the progress department and the works management through the departmental manager and his foremen, superintendents and the like.

Unless all these are prepared to accept the fact that a fundamental change in method has now to take place, the works are in for either a crashing failure or a prolonged battle of personalities.

Discipline

A new type of discipline has to be enforced, and all sorts of things that used to be hidden up encouraged into the open. Waiting time is no longer a sign of foremen's inefficiency; it is a signal for the progress department to pick up and remedy the shortage troubles at once, or the line will not move along at its appointed hour.

It is best to arrange that no one person in the shop has the power to move the line if any stage is incomplete at the allotted time for any reason whatever. One way to do this is to require a signature from the chief progress man and/or planning engineer to ensure that they have individually been warned of shortages at this late hour. The delay involved will be amply recompensed by the urgency with which the action is forced. If the departments concerned are worth their salt they will endeavour to make sure of the future position as well as taking the most desperate emergency steps to clear the present shortage.

It seems to me essential that men working on the stages should not be permitted to work in any other position, at any rate during the early stages after the initiation of the line. Otherwise it is impossible to get accurate enough information to re-balance and adjust discrepancies.

There is a very great temptation to all concerned to use up spare moments in getting the next job ready before it arrives at the next stage. This must be checked by explaining how necessary it is only to do the work as planned. Until they really see the necessity for real planning, and

Nearing the final stage, where Rotol airscrews are fitted to the Rolls-Royce engines.

hand the responsibility for waiting time or a check on the line back where it belongs, there is no hope of finding the real snags.

The simplest form of the system is:—

(1) The work is split up into stages.

(2) Each stage is carried out by men who do only that work.

(3) The work on a given stage is always carried out in the same geographical position. Until the whole line moves, no work may be done on other aircraft than that in the given stage by the associated group of men.

(4) The moment trouble of any sort occurs it must be notified. This can be done by a visual indication such as shortage boards located on the stage. If remote indications showing a stoppage or shortage can be fitted in managerial offices, so much the better.

(5) Waiting time must be shown as clearly as possible —*and no blame attached to those waiting.*

(6) Discipline on these points must be agreed. By discipline I mean willingness to keep exactly to instructions mutually agreed or accepted.

(7) Outside the shop, whoever is appointed to give the all-clear to move the line, even if there are shortages, must make arrangements to make them good without obstructing the normal stage work later down the line, before signing.

I have stressed the word "discipline," and it may appear that I advise a strongly regimented shop. This is not the meaning I intend. We found that certain fundamental rules were required to make the line system work. The objection was nearly always that the work would stop, time be wasted, waiting time booked, unless the rules were left to those most intimately connected with the shop to alter or amend at their own discretion. The "discipline" necessary was nearly always aimed at preventing work going on except to the plan.

Air Strategy—XVI

AIR BLOCKADE—VI

Germany Has Four Air Zones to Defend

By CAPTAIN NORMAN MACMILLAN, M.C., A.F.C.

WHATEVER the side issues of this war may be (and no one will deny that they are numerous, including, as they do, social and monetary problems, geographical problems, and varied problems of evolution among what we generally choose to call native races), the fact stands stark that nothing can be solved either way until British or German leadership is established. At the moment there is no leadership in Europe. There can be no leadership when war is rampant. The so-called leadership of war is a violent charge downhill backwards along the paths over which mankind has trod. The only lasting benefits which war produces are the advances in medicine, surgery, and the applications of science to industry; and they all arise out of the uncontrolled outpouring of money and the process of human vivisection which is war.

This struggle is a struggle for leadership, a leadership which the war of 1914-18 failed to establish. The challenger is Germany. If the German challenge is defeated, as it must be, there can be no other challenge to fear. For, when the British Empire emerges from the present ordeal, triumphant, the whole world will be prepared to line up with Britain. Thus, for the moment, all else can be relegated to the foot of the bill. Our target is Germany. With Germany seeking an armistice we shall be able to turn our face in other directions.

All We Can Spare

Until then all we can spare from the needs of sheer defence must be turned against the real foe. And that applies in the air more than in any other arm. For the air arm is the one arm we have which can strike at Germany direct. For the moment the major part of our Army is immobilised in Britain. The Navy is wielding its traditional weapon of sea blockade—an indirect thrust at the heart of Germany, but not a direct blow. The Royal Air Force, however, carries by day and night its war into the territory of the enemy.

There may be readers who will say that I have forgotten the war in the Mediterranean, in Africa, and the threat to our affairs in the Far East. Let me answer their criticism before it is formulated. I have not forgotten any one of the manifold avenues along which the warring nations of the world are pursuing their devious paths. But I am convinced that we need every ounce of strength to be concentrated against the one foe who can truly threaten the integrity of the British Isles, and to that end we must be prepared to sacrifice elsewhere for the time. But let me affirm that I believe that this policy will need to be adhered to only so long as the major issue of invasion remains to be decided; thereafter we can think again.

Rather more than two years ago I sat at lunch in a fashionable hotel in a fashionable winter resort on the Continent (which for the sake of those who might be identified I shall not name) and listened to the points of view of those seated near me. I sat next to a reserve officer of high rank who is no doubt now in uniform. And at that time those about me (and they were not

"For the purpose of air operations . . . . . it is desirable to divide Germany into four zones."

British) had no doubt that the German challenge was coming near. They had little doubt what it would mean. They were aware of the power which Germany had then amassed. And round about the place where we sat, but invisible to the ordinary visitor, were rising new defence fortifications.

It was extraordinary how calmly the certainty of the war was discussed. But perhaps that was because it was easier to "feel" the atmosphere there than in England. Anyhow, one remark stuck fast in my memory. This is what it was:

"The Italians are good road-makers. By the time England has taken back Abyssinia from them, the Italians will have done the pioneer (in the military sense) work for the benefit of England." It was obvious that my neighbour did not like and did not trust the Italians. It was clear that he expected the Italians to range themselves against the British. And it was certain that he anticipated a British victory—in the long run.

"Of course, Britain always starts as though she must lose," he said. "It's not until she thinks she's running a risk of losing that she makes up her mind that there's a war and she's got to win it. Germany is just the opposite. She starts out to win. That's why she collapses so hopelessly when she begins to lose."

A Matter of Temperament

There's a lot of psychological sense in that last remark. Quite a lot of useful propaganda could be built up around its summing up of the difference between the two nations. And there, in the heart of Europe, it was known more than two years ago that the war, when it came, would be a war between Britain and Germany, and that no other aspect of it would really matter. And it doesn't. Not yet. But it will, in time.

So it is necessary to decide how the Royal Air Force can be best used for the aggressive work that is essential

AIR BLOCKADE (CONTINUED)

to win the war. Apart from the protective work of the sea patrols, and the defensive work of the fighters, and the counter-attack bombing of enemy occupied aerodromes and ports, and quite apart from the work that the R.A.F. is called upon to carry out in other theatres of war and outposts of Empire, it is beyond question imperative to enlarge the campaign of direct attack upon enemy targets within Germany proper.

For bombs dropped upon enemy targets in Norway, Denmark, Holland, Belgium and France may be useful in immediate short-term strategy, but they cannot have a moral effect upon the German people, however much they affect the German troops. And in the meantime we must not forget that the spreading of our effort in that way has coincided with the intensification of the German effort against British ships and the soil of the British Isles. The best counter to that is to intensify the efforts we make against targets within the true Germany. To some extent that has been done. But more, far more, is needed to bring about the effect desired.

The Four Zones

For the purpose of air operations against Germany, with bases in the British Isles only from which to operate, it is desirable to divide the enemy territory into zones.

In Zone 1 I would include targets in Holland, Belgium, and North-West France.

In Zone 2 I would include targets in West Germany to the line connecting Hamburg—Hanover—Kassel—Frankfort-on-Main—Karlsruhe.

In Zone 3 I would include targets east of the line demarcating the eastern limit of Zone 2 to a line connecting Stettin—Berlin—Leipzig—Nuremberg—Ulm—Friedrichshafen, together with Denmark and South Norway.

In Zone 4 I would include all territory east of Zone 3 but outside the operating zones of the Royal Air Force units stationed outside the United Kingdom. Zone 4 would take in the territory of Germany east of the line Berlin—Friedrichshafen, East Prussia, German-occupied Poland, Czechoslovakia, Austria, Italy, the remainder of German-occupied France and Northern Norway.

Clearly, certain air operations over the sea would fall into each one of the Zones. The sowing of mines would fall mostly into Zones 3 and 4. Other Fleet requirements could be similarly zoned. The co-operation of the Fleet Air Arm could be planned to fit into a combined scheme, so that when required the general strategical employment of the whole offensive air arm could be co-ordinated.

Allocation of Tasks

It demands no very profound study of the aircraft of the Royal Air Force to determine into which zone category the various aircraft operated by the R.A.F. and the Fleet Air Arm can be classified. That gives a conception of the weight of air attack which can be brought to bear within any one of the zones. Further consideration of the targets which are of particular importance within each of the four zones gives some indication of the relative importance of the zones, and therefore of the weight of air attack which ought to be directed against each zone.

Zones 1, 2 and 3 are all of especial importance from the aspect of possible attempts at the invasion of the United Kingdom, for they all include ports which might be used to that end and they also cover the intervening sea. But this aspect of the war deserves special consideration. It is a specialised operation, whereas the regular bombardment of enemy territory and enemy-occupied territory is more like the steady war of attrition of artillery firing upon fixed zones. And it is with the latter aspect of air power that we are at present concerned in this article.

Whatever use Germany can make of the territories she has occupied (and one may be sure that she will make the most of them to further her war effort), it is certain that Germany herself must still be the principal source of the military supplies required by her armies and her air forces and her navy. Apart from the need for standardisation, it is obviously to Germany's advantage to augment her own sources of arms supply while diminishing the sources of arms supply of countries which she has overrun. For the conqueror always goes about with the sneaking dread that the peoples he has conquered may rise against him. They are safer disarmed. Besides, most of the arms factories in those countries in the western part of Europe which Germany has overrun are within easier reach of British bombers than many of the factories in Germany proper. So it is odds on that Germany will exploit those countries for purposes other than the augmentation of her actual arms manufacture.

Targets Within the Zones

So, for a moment, let us consider the four zones within Germany proper. Within those four zones lie the factories which have made possible the military successes so far achieved by the Third Reich. Within those four zones, moreover, lie the factories upon which Germany must depend to maintain the victories she has won. And so within those four zones lie the targets against which our bombers have been operating and against which they must continue to operate so that the sources of Germany's military and air power may be struck and their output reduced.

Here is a rough classification of the industrial value of the four zones, regarded from the military aspect.

Zone 1 is, at present at any rate, a zone target of operational importance. Within it the R.A.F. raid harbours, docks, aerodromes, canals, barges, railway stations. Zone 2, which is the first zone in Germany, contains a vast network of important industrial targets. Heavy industries of all kinds are to be found within it. Many raids have been made into this zone. There have been fewer raids in Zone 3, although it, too, is a zone in which there is a large number of highly important military targets. Zone 4 has not been raided since the R.A.F. returned from France. In this zone there are fewer targets of great industrial importance, but they are spread wid over it. And some of the targets which lie in this zone are so important as to demand a special study of the ways most likely to secure effective results by air attacks against them.

I shall have more to say about the detail of the actual targets in my next article. In the meantime it is important to note that since the elimination of France as a base for air operations, Zone 4 has been made more difficult to attack from the air. This change has been brought about, not my any fundamental difficulty in planning or executing such attacks, but solely in the extension of range which has resulted from the new situation.

The British conception of the war in the air always took into consideration the employment of bases in France. And aircraft were designed with that aspect

AIR BLOCKADE (CONTINUED)

of the struggle in view. On no other grounds could the specifications for some of the comparatively short-range aircraft which were built be justified, and certainly they are not justified to-day. Here I do not refer to the single-seat fighters, which by the very nature of their design cannot be other than short-range aircraft. Moreover, in action they use up their ammunition so rapidly, when their guns shoot at 1,200 rounds a minute each, as to require their return to the ground for a further load of ammunition. So they are not the kind of aircraft required for any but short-range jobs.

The kind of fighter needed for long-range work has not yet made its appearance on either side of the battle front. But before this war is very much farther on its way the need for long-range fighters of a new kind will have become apparent, and a terrific demand will arise for them. At the same time, it will be absolutely necessary for the R.A.F. to be equipped with longer-range bombers capable of dealing handsomely with every target in the areas which I have called Zones 3 and 4. And if those bombers are to operate during daylight (which will be necessary in attacks made upon Zone 4 during the summer months of 1941) they will have to be escorted. And why should they not be escorted? Technically, there is no reason why they should not be protected by an efficient type of fighter. And such fighters could easily be built. Purposely, I do not propose to discuss the layout of such fighters here, for a proposal of this nature might be of some value to the other side.

Next week I am going to describe some of the targets which lie in the three Zones I have outlined in Germany. In the meantime we have the autumn to get on with the production of new types of aircraft suitable for the changed conditions under which the R.A.F. Bomber Command has to operate. If things are handled properly we ought to be able to raid Zone 4 effectively next year.

CONSOLIDATED BOMBER XB-24 (Continued from page 145)

The co-ordinates for the upper or suction surface are determined by the two following equations:—

$$X_S = \sin\theta\,[0.6366198(A-B)+B] + \tan\theta\,[(1-0.6366198\,\theta)(1-A)]$$

$$Y_S = \cos\theta\,[0.6366198(A-B)+B] - A(1-0.6366198\,\theta)$$

A pair of similar equations defines the shape of the lower or pressure surface:—

$$X_P = \sin\theta\,[0.6366198(A-B)+B] + \tan\theta\,[(1-0.6366198\,\theta)(1-A)]$$

$$Y_P = \cos\theta\,[0.6366198(A-B)-B] - (A-2B)(1-0.6366198\,\theta)$$

(In all four formulæ, θ varies from 0 to $\pi/2$ radians.)

The values of A and B are kept constant for any one aerofoil. A sufficient number of values of θ should be used in order that the points found will be numerous enough to determine fair curves. If the constants A and B are given regular increments, a series of aerofoils can be constructed which will vary gradually in their properties.

The equation was developed from formulæs based on the mechanical action of a rotor having rotation and translation through a fluid.

This combination of rotation and translation produces a lift, and the phenomenon, known as the "Magnus effect," has been well known to theoretical and practical aerodynamicists for many years. The Flettner rotor ship was built on this principle, and every time one puts top-spin on a tennis ball to pull it down quickly after crossing the net, the phenomenon is utilised, the lift in this case having a negative value. Back spin, of course, tends to keep the ball in the air.

The Davis section as used by Consolidated is thinner than current practice and the thin wing has always been attractive aerodynamically, due to reduction of profile drag. But how to obtain a light structure with shallow wing spars is the stress analyst's difficulty, and progress on this problem must precede any aerodynamic advances in reducing wing thickness. The Consolidated 31 appears to be a very good boat, but not all its excellence comes from the wing section, for the general progress in structures and in design generally has contributed much to its success.

U.S. AMBASSADOR AT COASTAL COMMAND

On Wednesday of last week the R.A.F. Coastal Command who have done such excellent work, were honoured by a visit from Mr. J. Kennedy, the U.S. Ambassador in London. Left to right: Air Vice-Marshal F. G. O. Hards; Air Vice-Marshal G. R. Bromet; Air Commodore R. L. G. Marix; Mr. Kennedy; Capt. C. W. L. Meynell, R.N.; Lady Bowhill; Colonel Scanlon, American Air Attache; Air Chief Marshal Sir Frederick W. Bowhill, A.O.C.-in-C. Coastal Command; Pilot Officer Nunweek, personal assistant to the C.-in-C.; and Lieutenant W. Francis.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

ASSISTED TAKE-OFF

The Subsequent Climb

HIGH wing loading in an aeroplane makes for long range and high efficiency, but it can only be realised if special means are adopted for assisting the take-off.

This is the view (now almost a platitude), which is expressed weekly in *Flight* in articles by one eminent authority or another. In the issue of August 15 it appeared in that very interesting series "Air Blockade," by Captain Norman Macmillan. The previous week it appeared in Dr. F. W. Lanchester's article "Boost."

Though the statement is, as I have said, almost a commonplace, it is incomplete. The "take-off," as the phrase is normally understood, is over when the aeroplane has left the ground and crossed a hypothetical barrier of fifty or sixty feet. It may then start climbing at a rate of one or two thousand feet a minute, but because its forward speed is high the actual angle of climb is very small. Several typical modern aircraft, into whose performance we have looked, had initial climbing angles of less than 10 deg. If one of the engines were to fail during this time (and it is then that engines are notoriously liable to fail) the results may be catastrophic. Even though that did not happen, the pilot is in a very unhappy position until he has reached a safer height at which he can safely level out and from which he could jettison his large store of fuel if anything were to go wrong.

We need some other short phrase to define the "unstick distance, transition and initial climb to a safe height" part of an aeroplane's flight. Merely to shorten the "unstick" distance by reducing the ground drag (e.g., by using a smooth concrete runway), or by augmenting the thrust momentarily (e.g., by sloping the runway to gain some benefit from gravity or by fastening rockets to the wings), is not enough. Even "ground boosting" of the engines attempts more than that, and its benefit may be felt for the first few minutes of the flight until at a height of one or two thousand feet.

If we can afford them let us have long runways, but let us realise their limitations. Let us look beyond the end of the runway and if there is anything but flat desert below the horizon and clear sky above let us have doubts.

And let Dr. Lanchester re-check his calculations and extend them to cover the whole period during which assistance is needed. His 22.7 seconds is far too little.

I was glad to see that Captain Norman Macmillan advocated the development of refuelling in flight, since it is without the limitations of any other method of assisting the take-off. It has been proved cheap, simple and safe. It gives assistance as long as assistance is thought necessary and it saves the crew of the bomber or air liner from the risks due to staggering into the air with hundreds of gallons of potential fire on board.

Dr. Lanchester says "In order to reduce the load and so facilitate the take-off, the system of fuelling in the air may be adopted; this, however, is an amelioration rather than a solution."

In the "Concise Oxford Dictionary" I find "ameliorate" defined as "(Cause to) become better." If the C.O.D. definition is correct, Dr. Lanchester's sentence lacks precision. Has he read and studied "The Journal of The Royal Aeronautical Society, July, 1940"? The whole argument in favour of refuelling in flight, the advantage to be gained from it, and the methods used were set forth there.

MARCUS LANGLEY,
Flight Refuelling, Limited. Technical Manager.

THE AIRCRAFT INDUSTRY

Designing for Production

THERE have been many references in *Flight* recently on the above subject, and the letter by "Sub-Contractor" in the July 18 issue undoubtedly has many items of truth in its remarks.

I should like, as the chief of a large jig and tool design office of a well-known northern aircraft firm, to give my views on this.

Whilst doing so I am fully aware that I shall bring a storm of abuse on my shoulders from many aircraft designers. But a jig and tool designer is a fully trained production man, with workshop experience. He is generally a first-class mathematician, owing to the vast amount of trigonometrical calculations he has to make for jig boring work; and in many cases deriving dimensions by calculation from drawings made by aircraft design staff, who are not workshop trained or production minded.

I am not going to state that dimensions are *always* missing; but often they are given in a manner that is not suitable for production. Or when components are being checked by the Inspection Dept. they are not given from the correct location face.

My suggestions are similar to "Sub-Contractor's," i.e., that in every aircraft drawing office there should be a qualified tool and production expert who, before drawings are traced and issued, should peruse the design and, if necessary, submit his suggestion for any modifications which may improve production.

I am afraid I have to agree with "Sub-Contractor" and his remarks on tool costs. The responsibility, however, I do not think rests with him.

Most parent firms have advanced considerably in recent years on aircraft production: The spindling and routing of components has saved thousands of pounds on costly blanking tools that used to be employed.

The use of the hydraulic press for forming of aircraft pressings by rubber has been developed immensely. There are many more ideas that have been evolved for production in the aircraft world, but do the sub-contractors know of all these ideas? The British aircraft industry is still very conservative in regard to the pooling of ideas.

I think that sub-contractors should have their managers and production men trained for a short spell by their parent firm, and should furthermore be advised as to the kind of jigs and tools to make.

I myself have been to sub-contracting firms and have seen their jigs and tools made and in production. I realised afterwards that there was no need to manufacture tools of such a costly nature, but then, of course, it was too late; the money had been expended.

As regards "Sub-Contractor's" remark concerning the easing of inspection work, I am afraid, with work undertaken by sub-contractors, I would not readily agree to this. I have found that, in some cases, work done by sub-contractors does not always come up to the standard of their parent firms, which are often put to considerable trouble by doing their utmost to utilise components that might have been rejected if made in their own works.

Again, however, a lot of this trouble could be avoided if sub-contractors, new to the aircraft business, were made fully aware of the limits required from them.

Leeds. G. S. BIRD.

Aircraft Production in Australia

THE Prime Minister, Mr. R. G. Menzies, announced a short time ago that the first Beaufort airframe will be delivered in April, 1941. Pratt and Witney Twin Wasps will be fitted to these aeroplanes instead of the sleeve-valve Bristol Taurus. Production of the Wasps in Australia is to start early in 1941.

In the meantime Commonwealth Aircraft Corporation is pushing ahead with the manufacture of Wirraways and has an order for 800.

Simultaneously, the Corporation (which is a private company with capital derived largely from the Broken Hill Proprietary Company) is going on with the development of a light reconnaissance twin-engined bomber of its own design. It has also another design of its own, a two-seater open cockpit trainer behind a Gipsy Major engine. The manufacture of these engines has already been undertaken under licence in Australia and the first of them is expected from General Motors-Holden shortly.

The Council for Scientific and Industrial Research (more shortly, the C.S.I.R.) is doing research work to determine whether there is a suitable Australian timber to replace the imported spruce, and so make the Commonwealth independent of outside supplies, for its structural materials, for trainers at any rate. It is also seeking an Australian timber for plywood-making, and it is believed that results are so far very encouraging on both these projects. So much so that the Air Board (controlling the R.A.A.F.) has requested the investigation of the construction of a wooden twin-engined advanced trainer.

HERE and THERE

WELL MET! The American Clipper of Pan American Airways arrives at Auckland, New Zealand, after its flight from California. Already moored is the British Trans-Tasman flying boat Awarua, which carries the mail on to Australia.

Capt. Balfour's Trip

AMONG the passengers on the British Overseas Airways flying boat *Clare*, which arrived in Canada on August 15, from the United Kingdom en route for New York was Captain H. H. Balfour, M.C., M.P., Under-Secretary of State for Air. Captain Balfour, who is accompanied by his Parliamentary Private Secretary, Flt. Lt. W. W. Wakefield, M.P., is visiting Canada to discuss various matters in connection with the Empire Air Training Scheme.

Mounting Ever Higher

PUBLIC subscriptions to buy aircraft for the Royal Air Force are increasing with every day that passes, and the total has now reached the impressive figure of £3,052,841, it is announced by the Ministry of Aircraft Production. If a Spitfire or a Hurricane costs about £5,000 or £6,000, this amount is enough to buy a fleet of five or six hundred. Used for bombers at say, £25,000 to £30,000 each, it would provide between 120 and 150.

One of the latest gifts is £5,000 from the small village of Michaelston-le-Pit in South Wales.

"Freely Give"

MANY towns and villages up and down the country are arranging exhibitions of aeronautical photographs and drawings in connection with special collection weeks to raise funds for the purchase of fighter and bomber aircraft. This spontaneous gesture on the part of the public has much to commend it, and large sums have already been raised.

The exhibition organised by Croydon's Fighter Fund, at "The Crown," North End, Croydon, was an entire success, and the Croydon fighter is already on the way. An actual example of a Gypsy trainer aircraft was on view, together with a number of *Flight* photographic enlargements, sectional drawings of aircraft, and the *Flight* identification charts of British, German, German troop-carrying and Italian aircraft. The Air Ministry also lent photographs. Councillor T. H. Brain, the honorary secretary of the fund, tells us that a damaged Messerschmitt is to be exhibited at the Fairfield Car Park this week.

Next week a similar aeronautical exhibition is being arranged by His Worship The Mayor of Shoreditch in connection with the Shoreditch effort, while another notified to us is that at Sutton Coldfield on September 9th. Here an exhibition of *Flight* photographic and other material is being arranged by Mr. Edward H. Reeves, the Midland advertising consultant.

War Photographs

SOME fine examples of air photography under wartime conditions are to be seen at the Exhibition of Royal Air Force War Photographs which opens on Friday (August 23) at the Building Centre, 158, New Bond Street, London, W.1.

The exhibition, which has been organised in conjunction with the Ministry of Information, illustrates almost every phase of life and work in the Royal Air Force. One series of pictures shows bombers carrying out the various stages of their task. Another series shows how Fighter pilots repel enemy raiders.

Sections are devoted to the work of the Coastal Command, the Balloon Barrage, Army Co-operation and activities in the Dominions. The expansion of aircraft production in this country is the subject of some striking pictures, and others illustrate the various stages in the training of pilots, air gunners, observers and aircraftmen.

On both sides a large amount of photographic reconnaissance has been carried out during the present war, but unlike the Germans, whose photographs, many of them faked, have been profusely distributed over the neutral world, we have been modest in publicising the valuable results of our camera work. The Exhibition is a welcome indication that this shyness is gradually being overcome. It should prove extremely popular among the public.

The Exhibition will be open each day (excluding Sunday) from 10 a.m. to 6 p.m. Admission free.

Blind Flying Hood Release

THE U.S. Army Air Corps have developed a blind flying hood which automatically folds back at air speeds outside the range of 130 to 230 m.p.h. The hood operates by the withdrawal of a latch by an electrical solenoid, so allowing the elastic members of the hood to fold it back out of the way.

Such a hood is designed to increase the pupil's confidence, as he knows that in a stall or a dive it will open by itself.

I.O.D.E. PRESENTATIONS: A Bristol Bolingbroke given to the Royal Canadian Air Force by the Imperial Order of Daughters of the Empire was recently handed over at Ottowa. Present at the ceremony, and seen from left to right in the photograph, are Wing Cdr. McLeod ; Princess Alice ; Mrs. W. B. Horkins, I.O.D.E. President ; the Earl of Athlone, Governor-General of Canada ; and Air Comdre. L. S. Breadner, Chief of Air Staff, R.C.A.F. The Bolingbroke, it will be remembered, is a Canadian variant of the long-nosed Bristol Blenheim. Like the Blenheim it is powered with two Mercury VIII engines and has a top speed of nearly 300 m.p.h. at 15,000 ft. The armament consists of one forward-firing gun mounted in the port wing and one free gun in a retractable power-operated turret situated mid-way on top of the fuselage.

SERVICE AVIATION

Royal Air Force Awards and Official Announcements

V.C. Awarded

THE KING has been graciously pleased to confer the Victoria Cross on the undermentioned officer in recognition of most conspicuous bravery:

Act. Flt. Lt. R. A. B. Learoyd. This officer, as first pilot of a Hampden aircraft, has repeatedly shown the highest conception of his duty and complete indifference to personal danger in making attacks at the lowest altitudes regardless of opposition. On the night of August 12th, 1940, he was detailed to attack a special objective on the Dortmund-Ems canal. He had attacked this objective on a previous occasion, and was well aware of the risks entailed. To achieve success it was necessary to approach from a direction well known to the enemy, through a lane of especially disposed anti-aircraft defences and in the face of the most intense point-blank fire from guns of all calibres. The reception of the preceding aircraft might well have deterred the stoutest heart, all being hit and two lost. Flt. Lt. Learoyd, nevertheless, made his attack at one hundred and fifty feet, his aircraft being repeatedly hit and large pieces of the main planes torn away. He was almost blinded by the glare of many searchlights at close range, but pressed home this attack with the greatest resolution and skill. He subsequently brought his wrecked aircraft home, and, as the landing flaps were inoperative and the undercarriage indicators out of action, waited for dawn in the vicinity of his aerodrome before landing, which he accomplished without causing injury to his crew or further damage to the aircraft. The high courage, skill and determination which this officer has invariably displayed on many occasions in the face of the enemy sets an example which is unsurpassed.

Indian Air Force Expansion

INDIA is establishing two new flying training schools and two centres for technical training to cope with the expansion of the Indian Air Force.

Apart from sending pilots to England to serve with the R.A.F., it is intended that a reserve of 300 pilots and 2,000 mechanics shall be built up for their own air arm. Recruiting keenness is such that no fewer than 18,000 applications were received for 350 vacancies.

French Air Force

THE fighter aircraft, mostly of American origin, which were flown here by their French pilots at the time of the capitulation by the Pétain Government, have now been repaired. They will now belong to No. 1 Fighter Training Squadron of Gen. de Gaulle's army and will be flown by the French pilots who are being retrained ready for action.

Awards

THE King has been graciously pleased to approve the following awards for gallantry and devotion to duty in the execution of air operations:—

SECOND BAR TO THE DISTINGUISHED SERVICE ORDER.

Wing Cdr. Basil Edward Embry, D.S.O., A.F.C. During the operations over the Low Countries and France, Wing Cdr. Embry continued to display an extremely high standard of leadership and resolution in carrying out all the tasks allotted to his squadron, raising its morale to a high level and setting an example to the other squadrons in his group. He has shown a high sense of duty and determination.

BAR TO THE DISTINGUISHED FLYING CROSS.

Act. Flt. Lt. A. H. Boyd. This flight commander has been actively engaged in flying operations against the enemy since the commencement of hostilities. By fine leadership and dauntless spirit he has enabled his flight to destroy a large number of enemy aircraft of which he has himself shot down, or severely damaged, at least twelve.

Act. Flt. Lt. R. G. Dutton. This officer has led patrols with conspicuous success and has personally destroyed at least 12 enemy aircraft. He has displayed splendid qualities of leadership and courage, with a complete disregard for his own safety.

DISTINGUISHED FLYING CROSS.

Wing Cdr. John Goodenough Elton, A.F.C., Sqn. Ldr. Jack Cuthbert Larking, Sqn. Ldr. Anthony Dunkerton Selway.

READY TO PUT THE MESS IN MESSERSCHMITT: Any enemy fighter attacking these five Blackburn Rocs of the Fleet Air Arm is up against the concentrated fire of twenty Browning guns in power-operated turrets, a fire power of 24,000 rounds per minute.

Flt. Lt. C. D. Griffiths; F/O. G. P. Christie; F/O. C. T. V. Craxton; F/O. E. Holden; P/O. J. MacG. Talman.

Sqn. Ldr. G. B. Keily, A.F.C. On 28th July, 1940, Squadron Leader Keily was the pilot of an aircraft detailed to carry out a special reconnaissance over Libya. The reconnaissance had to be carried out at a low altitude owing to clouds. He was attacked by five enemy aircraft but, displaying great skill, he destroyed one of them. During the engagement the air observer was hit by a bullet. Notwithstanding the handicap of having the air observer's body leaning against him, Squadron Leader Keily continued with the reconnaissance, returning with information of great value. He has invariably displayed exceptional leadership, courage, and devotion to duty.

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. F. G. Berry. In June, 1940, whilst leading a section on patrol over Saint Nazaire to cover the embarkation of the British Expeditionary Force, Sgt. Berry attacked and shot down an enemy bomber about to make an attack on one of the troopships. Sgt. Berry has on many occasions led his section, and often his flight, in combat against the enemy with success. He has displayed exceptional qualities as a leader.

Sgt. A. V. Clowes. Sgt. Clowes has displayed courage and determination in many combats against the enemy. He has destroyed at least six enemy aircraft. In June, 1940, he led his section in combat against five Messerschmitt 109's and destroyed one. He then observed, above him, three further enemy aircraft and, before they could attack his flight, he engaged them. He succeeded in damaging one and in causing the other two to disperse in the clouds. He has displayed great skill and power of leadership.

Sgt. R. H. Burrows; L.A/C. R. J. Utteridge.

Prisoners of War

THIS is the latest list of R.A.F. prisoners in enemy hands received from German sources.

Sgt. J. Fiske, Brentwood, Essex; Sgt. L. Ascombe, Leeds, 12; P/O. D. Dakarness, Battersea, S.W.11; P/O. L. M. J. Lewis, Chichester, Sussex; Sgt. S. Fieldhouse, Hull; Flt. Lt. E. C. S. Putrell, Farnham Common, Bucks; Sgt. E. V. Gorweth, Winchester, Hants; Sgt. K. B. Wood, Oldham, Lancs; Sgt. P. R. Donaldson, London, S.W.7; Sgt. J. P. Atkinson, 149, Goddard Avenue (no further address given); Flt. Lt. E. A. French-Mulland, c/o Air Ministry, London; L.A/C. A. G. W. Millar, Ruthergien, Glasgow; P/O. W. A. Carr, Eastleigh, Somerset; P/O. J. P. North Lewis, Burford, Oxford; Sgt. G. A. Allison, Oulton Broad, Norfolk; Sgt. C. C. G. Hawkins, Wembley, Middx.; Sgt. H. W. J. Smith, Nr. Rochester, Kent; Sgt. A. Avory, Sheffield; Sgt. Adams, address not known (wounded); Sgt. G. J. W. Gribbs, Putney, S.W.15; Sgt. T. Johnson, address not known (wounded).

Roll of Honour

AIR MINISTRY CASUALTY COMMUNIQUE No. 42.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed.

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—Sgt. J. J. Barry, 518370; Sgt. F. W. Eley, 745677; Sgt. G. J. Harnden, 751159; Sgt. C. J. Holland, 745631; Sgt. P. E. Johnson, 550384; Sgt. L. Land, 623762; Sgt. B. C. Long, 580616; L.A/C. A. Mackintosh, 520842; F/O. B. E. Moss, 72027; P/O. W. A. C. Mulloy, D.F.C., 40636; Cpl. G. Niven, 566120; Sgt. T. J. Radley, 646336; Sqn. Ldr. H. C. Sawyer, 33144; Sgt. C. J. Shewry, 550468; Sgt. S. Smith, 623798; P/O. T. N. Taylor, 77205; Flt. Sgt. S. P. Tomley, 565434; Sgt. G. R. Watt, 522273; Sgt. A. G. Willis, 568341.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED," NOW PRESUMED "KILLED IN ACTION."—Sgt. J. H. Hanne, 564212; A/C.1. E. Vick, 540325; Act. Sgt. G. L. Williams, 524733; Flt. Lt. A. N. Wilson, 90300

PREVIOUSLY REPORTED "MISSING," NOW PRESUMED "KILLED IN ACTION."—P/O. A. Barkley, 41246; P/O. J. B. Beer, 41364; A/C.2. D. J. Drury, 625339; A/C.1. T. Finnigan, 547574; A/C.2. A. Hinchliffe, 610120; Act. Sgt. W. H. C. Kidd, 563851; P/O. R. C. Lloyd, 41594; A/C.2. W. T. Lowey, 619235; P/O. A. J. Macdonald, 36176; L.A/C. A. J. Mantle, 521552; L.A/C. H. S. Morton, 551834; Sgt. J. Morrice, 580290; Cpl. D. Turner, 526986; Sgt. H. R. B. Wakeham, 563597.

SERVICE AVIATION (CONTINUED)

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—Sgt. C. A. Bartlett, 624718; Sgt. E. J. Belcher, 580477; Sgt. J. P. Boddington, 523009; L.A/C. C. S. Burt, 542020; L.A/C. J. Craig, 759047; P/O. C. D. Frost, 42342; A/C.2. J. H. Patterson, 626953; P/O. B. D. G. H. Reid, 42438; P/O. B. A. Taylor, 40443.

WOUNDED OR INJURED IN ACTION.—P/O. J. C. Carriere, 41825; L.A/C. R. E. Chamberlain, 749364; P/O. D. J. Fletcher, 41166; Flt. Lt. P. W. Hartley, 37354; L.A/C. G. H. Howgate, 530552; L.A/C. G. J. Humphreys, 534289; Sgt. J. R. A. Jones, 580403; P/O. J. H. Lancaster, 41794; F/O. A. D. J. Lovell, 40402; Sqn. Ldr. R. H. Maw, 32090; Sgt. E. A. Mould, 741299; P/O. R. A. G. Paramore, 42522; Sgt. L. A. J. Patey, 562925; F/O. J. M. Strickland, 39581; Sgt. W. W. Thompson, 525810; A/C.1. P. Thomson, 907962; Sgt. L. Trimby, 747894; P/O. D. R. Turley-George, 41336; L.A/C. J. C. Wharton, 616661.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—P/O. B. S. T. Brookes, 81734; Act. Sqn. Ldr. W. I. Collett, 34332; Cpl. F. M. Dunn, 516796.

PREVIOUSLY REPORTED "PRISONER OF WAR," NOW REPORTED "DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION."—F/O. A. R. Ball, 40069; Sgt. C. Shelton-Jones, 563688.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. N. W. Brown, 518807; P/O. W. H. Coleman, 39781; Sgt. J. Dowds, 632780; Sgt. W. E. Neville, 631165; P/O. F. T. Poole, 42722; L.A/C. P. D. Snowden, 526768; Sgt. A. L. Stewart, 624161.

MISSING.—Sgt. G. J. Andrew, 746706; P/O. W. L. Ather, 44226; Sgt. W. S. Barrett, 905832; Sgt. V. St. G. Barrow, 542271; P/O. B. S. Bell, 40663; Sgt. G. F. Brixton, 511134; Sgt. K. R. Bryant, 755318; P/O. J. R. Buchanan, 77033; Sgt. W. G. Cameron, 548486; Sgt. J. R. Close, 653790; Flt. Sgt. C. J. Cooney, 564567; F/O. H. C. Corbett, 72466; Sgt. R. W. Cornwell, 747814; Sgt. V. A. Coveyduck, 580711; F/O. P. A. N. Cox, 33184; Sgt. J. J. Crabtree, 523092; Sgt. J. M. Croft, 635759; Sgt. A. Cross, 534022; L.A/C. A. T. Cumner-Price, 517893; Sgt. J. Dempsey, 640266; P/O. D. A. Drew, 79539; Sqn. Ldr. P. E. Drew, 26199; F/O. P. F. Eames, 70196; Sgt. J. H. R. Edgar, 581149; L.A/C. L. H. Edwards, 293387; P/O. R. H. Edwards, 42113; Sgt. C. D. Evans, 617444; P/O. H. P. G. Fisher, 78443; Sgt. J. C. Franks, 517572; F/O. D. R. Gamblen, 39657; Sgt. B. P. Gannon, 741151; P/O. R. T. Gerry, 41013; Sgt. K. V. Gibson, 905664; P/O. J. A. Gilbert, 41399; P/O. J. D. Goode, 40691; P/O. H. R. Gunn, 43067; F/O. H. Haswell, 72482; Sgt. F. A. P. Head, 920546; Sgt. A. G. Herbert, 749485; Sgt. H. F. Heritage, 524595; Sgt. R. McG. Hettle, 645617; Sgt. J. Holdsworth, 749458; P/O. A. D. Hopkin, 36220; P/O. J. H. Horan, 41417; Sgt. L. J. Horton, 543161; Sgt. R. E. Hotchkiss, 653176; Sgt. H. W. Hunt, 580455; F/O. A. J. O. Jeffrey, D.F.C., 39740; Sgt. W. L. Johnston, 759044; P/O. F. H. Jones, 44074; Sgt. G. W. Jones, 590727; F/O. F. W. S. Keighley, 70772; P/O. M. J. A. Kirdy, 36254; Sgt. N. Longclune, 747748. P/O. B. M. McDonough, 42137; Sqn. Ldr. J. G. Macintyre, 36015; P/O. A. L. McLaggan, 77985; Sgt. K. D. Macpherson, 615194; Sgt. R. B. Martin, 751104; Sgt. W. E. Miller, 742485; Sgt. S. Morgan, 539583; Sgt. B. Moriarty, 615346; Sgt. P. Murphy, 532831; Act. F/O. B. Nokes-Cooper, 77362; Cpl. W. Norris, 351799; Sgt. J. Parkinson, 748411; Sgt. J. W. H. Parsons, 563997; P/O. B. C. Paton, 42021; P/O. M. A. Phillips, 81002; P/O. B. A. Power, 75988; P/O. R. W. Pryor, 42723; Sgt. L. H. M. Reece, 747825; Sgt. S. E. Riddington, 751028; P/O. C. H. Robinson, 70873; Sgt. G. P. Rowe, 751202; Flt. Sgt. R. J. Ruffell-Hazell, D.F.M., 359517; P/O. J. L. Scott, 42728; Sgt. K. R. Sellwood, 743306; P/O. R. E. Short, 42770; F/O. Lord Shuttleworth, 70356; Sgt. D. B. Simpson, 755136; P/O. D. B. Starky, 41752; Act. Flt. Lt. I. C. Swann, 39950; Sgt. P. W. Swinson, 620418; Sgt. D. Tailford, 526290; Sgt. J. H. Thain, 563421; Sgt. D. G. J. Townsend, 580075; P/O. M. R. Turnbull, 42915; P/O. W. D. Tweddell, D.F.C., 40767; Sgt. K. G. Walker, 625837; Sgt. D. Wallace, 628797; P/O. S. J. S. Wilde, 76931; Sgt. E. A. Will, 580929; L.A/C. J. Woods, 545046; P/O. J. H. R. Young, 42670.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE (WHILE ENGAGED IN NON-OPERATIONAL FLYING DUTIES, OR ON THE GROUND THROUGH ENEMY ACTION).—A/C.2. R. E. Barker, 939176; Act. Cpl. M. A. Barringer, 911627; Sgt. D. V. Mobberley, 641364; P/O. T. J. Powell, 42643; Sgt. E. Waite, 590565; L.A/C. T. Ward, 1152201.

KILLED ON ACTIVE SERVICE.—P/O. C. J. Allsup, 41539; P/O. P. D. Arup, 74658; P/O. A. Bailey, 40976; Sgt. S. N. Baker, 645894; Sgt. H. N. Beard, 581138; Sgt. G. H. Bell, 748794; P/O. K. G. Bishop, 81738; P/O. B. H. Black, 90139; Sgt. G. C. Brams, 700497; P/O. H. W. A. Britton, 42458; P/O. K. C. Campbell, 79155; Sgt. N. F. Cooper, 745487; Sgt. J. H. Culverwell, 529270; Sgt. O. C. Day, 742004; L.A/C. W. R. Driscoll, 912728; Sgt. P. P. Duffy, 525887; Sgt. M. V. Everitt, 654354; P/O. A. V. Fisher, 43702; Sgt. D. L. Griffiths, 742081; Sgt. R. Hanna, 741853; P/O. M. Hohnen, 42752; Sgt. G. J. L. Johnson, 742087; P/O. E. J. Lester, 42851; P/O. C. G. Llewellyn, 80831; Act. P/O. D. M. March, 42860; Sgt. H. E. Masters, 612668; Flt. Sgt. B. Nelson, 560353; P/O. K. O'ewinski, 76753; Act. Flt. Lt. J. W. Radbone, 70558; Flt. Lt. J. L. Rees, 39158; A/C.2 G. W. Rhodes, 996999; Sgt. W. Robb, 628511; Flt. Lt. H. W. A. Sheahan, D.F.C., 37266; P/O. R. O. Shuttleworth, 76022; Sgt. C. J. Smewin, 580591; Sgt. J. P. Smith, 742763; P/O. I. W. Sutherland, 72508; F/O. G. H. Thevenard, 70668; Sgt. J. B. Thompson, 566058; Sgt. R. C. Thomson, 759316; Sgt. W. H. Tibbles, 754133; Sgt. F. J. Tremeer, 510762; Flt. Sgt. W. G. Tyler, 516399; Sgt. J. P. Walsh, 754138; Sgt. W. Watson, 630423; Act. Flt. Lt. H. R. Wheeler, 70727; Sgt. E. P. Wood, 755876; Sgt. H. G. Worton, 903377; Act. P/O. D. J. Young, 91232.

PREVIOUSLY REPORTED "MISSING BELIEVED KILLED," NOW PRESUMED "KILLED ON ACTIVE SERVICE."—L.A/C. A. C. Beech, 751022; A/C.2 J. C. Buckland, 619734; P/O. A. Cameron, 41900; P/O. C. R. Coventry, 40606; Act. Sgt. A. G. Gibson, 581212; A/C.2 H. O. W. Gormlay, 543996.

PREVIOUSLY REPORTED "MISSING," NOW PRESUMED "KILLED ON ACTIVE SERVICE."—Sgt. T. A. Kerr, 700116.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.2 E. S. Budd, 977714; P/O. C. W. W. Darwin, 42050; P/O. R. S. Don, 81348; Sgt. A. B. Gordon, 745651; A/C.1 R. Gordon, 643772; P/O. J. J. Kaye, 80613; Sgt. E. Kibble, 742603; Sgt. P. Killick, 741726; Sgt. J. S. Midgley, 581195; P/O. E. G. Parkin, 79735; Sgt. O. K. D. Pulvermacher, 742576; L.A/C. N. D. Ricks, 968763; L.A/C. R. M. Ross, 937715; Sgt. D. R. Stubbs, 745426.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.2 E. J. Ayres, 646078.

DIED ON ACTIVE SERVICE.—Flt. Lt. W. M. Blom, D.F.C., 40041; Sgt. H. A. Bowmer, 580692; A/C.2 V. G. Bray, 1251395; Cpl. P. Callicott, 370335; Sgt. W. H. J. Franklin, 522061; Group Capt. G. C. Gardiner, D.S.O., D.F.C., 04014; Sgt. A. E. F. Gould, 524674; L.A/C. H. Goulding, 334035; Sgt. E. W. R. Grieve, 509087; L.A/C. G. A. Hall, 619068; A/C.1 D. W. G. Johns, 573409; L.A/C. S. Jones, 533240; A/C.2 A. Magasiner, 1151662; A/C.1 R. Murton, 541698; A/C.1 A. E. Preston, 848506; L.A/C. J. M. Ross, 524866; A/C.2 N. Russell, 985754; A/C.2 G. Scott, 770635; Cpl. D. H. Sharp, 619842; A/C.2 W. E. Smith, 650388; A/C.1 F. Stewart, 638353; P/O. S. Thompson, 79787; A/C.2 R. S. Tomlinson, 1052556; A/C.2 T. H. Williams, 948463.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "SAFE."—P/O. P. V. Arderne, 40658; L.A/C. F. G. Bowen, 533761; L.A/C. A. H. E. Joliffe, 509040; L.A/C. H. V. Richmond, 350828.

PREVIOUSLY REPORTED "PRISONER OF WAR." NOW REPORTED "SAFE."—Wing Cdr. B. E. Embry, D.S.O., A.F.C., 09252.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "PRISONER OF WAR."—Sgt. R. J. Baghurst, 640031; Sgt. A. C. Bailey, 740182; F/O. L. E. Chambers, 40289; Sgt. A. G. B. Crouch, 580508; Sgt. D. H. Dunt, 581148; P/O. J. E. A. Foster, 77953; L.A/C. C. K. Hand, 544342; Sgt. E. G. Hayward, 564673; Sgt. D. J. Holliday, 565717; A/C.1 W. F. Hubbard, 620073; P/O. V. Kelly, 77532; Sgt. S. Lang, 561779; F/O. P. G. Leeson, 90250; P/O. J. M. Lewis, 41035; A/C.1 H. Long, 615961; Sgt. J. A. A. Luck, 524114; L.A/C. E. T. D. Machell, 524148; P/O. D. F. M. Mackarness, 42244; Sgt. L. A. Morris, 741203; L.A/C. D. L. Phillips, 545177; P/O. J. P. Quirke, 42646; Sgt. G. W. Robson, 580228; Sgt. E. Rodgers, 620018; P/O. T. N. C. Rothwell, 41475; Sgt. H. Rowson, 509523; Cpl. R. K. Rye, 55184; P/O. J. B. Smiley, 42156; Act. Flt. Lt. J. W. Stephens, 40028; L.A/C. W. W. Street, 539338; L.A/C. E. L. H. Thomas, 539394; P/O. K. S. Toft, 70879; Flt. Lt. P. E. Warcup, 33294; L.A/C. H. P. L. White, 528627.

Royal Australian Air Force

WOUNDED OR INJURED IN ACTION.—L.A/C. G. H. Booth, 2743.

Royal New Zealand Air Force

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. D. F. Annan, A.391377.

MISSING.—Act. Flt. Sgt. R. A. J. Anderson, 36138; Sgt. J. L. Owen, A.391332.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. H. C. Downs, A.39965.

London Gazette

ROYAL AIR FORCE.

General Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Warrant Officer: (June 26, Sen. June 20) J. R. Law. Flight Sergeant: (July 17, Sen. June 24) C. Stokes. Sergeants: (June 27, Sen. April 25) G. W. Forster; (June 30, Sen. April 25) W. L. Ather; (July 4, Sen. May 9) C. B. Walter; (July 17, Sen. May 9) R. A. Howard.

The undermentioned Flight Lieutenants are granted permanent commissions in the substantive rank of Flight Lieutenant:—(Sept. 22, 1939) C. F. Barsby; (March 16) J. B. Black, B. G. Morris; (April 3) C. N. Fleming, G. A. Richmond.

The undermentioned are granted short service commissions as Pilot Officers for five years on the active list: (July 20) N. L. R. Cowan, R. L. Spurdle, C. Stewart.

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(June 10) M. P. C. Holmes, D.F.C.; (June 12) B. G. Aston, A. Darling; (June 26) J. J. Barr, P. E. Berry, R. J. Boret, W. D. Boxwell, M. F. C. Buckbarrow, J. F. B. Carey, G. C. T. Carthew, A. W. Clarke, C. Cookson, R. O. Day, H. G. De Forest, F. G. R. Dench, H. Downey, H. W. Eliot; (June 26) D. Evans, B. L. Fox, A. V. Gifkins, J. L. G. Glaister, I. P. C. Goudge, C. H. Gould, G. H. Green, P. A. Haggarty, A. C. Hamman, F. N. Hargreaves, D. G. Hayward, C. A. Hobson, R. A. Hubbe-Richards, J. M. Jackson, M. A. Kyle, G. J. Le Mar, D. McIntosh, J. D. Mallinson, J. L. Maude-Roxby, R. E. Maurer, J. R. B. Meaker, W. G. Mellor, J. M. Milburn, W. A. Mostyn-Brown, J. R. S. Oelofse, J. C. Paish, E. B. Panter, G. Parker, B. A. Primavesi, W. P. H. Rafter, C. D. Rash, B. Reynolds, R. A. Rhodes, M. Rowell, R. D. Rutter, M. C. G. Sherwood, A. J. J. Steel, S. C. Stone, H. J. C. Tudge, E. H. Upton, H. D. Vander Linden, E. O. Walsh, J. J. Walsh, G. P. Welman, J. N. Westcott, S. G. Whiting, L. G. Williams, W. P. Collins, C. B. Rigg, B. V. Kerwin; (June 28) D. C. F. Coutts, G. J. Cox, G. G. Crawford, J. A. Dixon, J. Harrison-Broadley.

The undermentioned Acting Pilot Officers on probation are graded as Pilot Officers on probation:—(June 2) D. M. March, J. F. Soden; (June 10) E. J. Coleman; (July 6) A. B. Watkinson; (July 12) J. H. J. Sauvage; (July 13) D. R. Bagnall, A. F. Berry, R. H. Crush, D. G. Dickie, F. K. Gill, R. J. Hannan, G. H. F. Inniss, J. T. Johnston, H. H. J. Miller, I. S. Smith, N. A. Svenson, C. F. Tibbitts, W. B. Christophers, J. L. W. Ellacombe, R. W. G. Beley, H. L. Marshall, R. E. Fawcett, J. D. Reardon, A. R. Zatonski, H. G. Keartland, W. J. Sipprell; (July 14) A. J. Faris, R. M. A. Lakin; (July 15) J. Cutmore; (July 20) J. B. Robertson; (July 27) R. G. Ash, C. D. Chapman, G. J. Cornish, J. L. Heron, A. J. Holland, H. M. Macrossan, J. McIntosh, P. B. Moore, M. J. Preece, J. O. Slatter, A. Tindal, R. E. Kerr.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(July 24) D. L. Rayment; (July 25) R. J. Oxley; (July 27) L. S. Dawson, B. P. Jones; (July 28) M. N. McF. Kennedy.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(May 25) D. F. W. Darling, W. D. Beckingham; (June 17) J. E. R. Hayter; (June 25) F. G. Quick; (July 6) R. C. Young; (July 25) F. A. G. Lascelles, C. A. Webster.

Air Comdre. F. P. Don, O.B.E., is granted the acting rank of Air Vice-Marshal (July 20).

The undermentioned are transferred to the Technical Branch (April 24):—Group Captains: A. Mayorin, O.B.E., C. Turner, A.F.C.; D. F. Lucking. Wing Commanders: C. W. C. Coaker, C. F. Chinery, O.B.E., J. A. G. De Courcy, M.C. (retd.), T. R. Cave-Brown-Cave, C.B.E., G. B. M. Rhind, E. C. Dearth, G. C. Shepherd, G. W. Birkingshaw, M. W. C. Ridgway, T. O. Clogstoun. Squadron Leaders: G. M. Buxton (since promoted), J. Mutch, J. C. Pope, H. M. Russell, R. G. Shaw, J. K. Rotherham, J. V. Read, M.B.E., W. F. Beckwith, H. B. Hurley, A. P. Chamberlain, G. H. H. Procter, W. N. Ash, D. Price, A. F. Bandidt. Flight Lieutenant: H. J. Irens.

The undermentioned Pilot Officers relinquish their temporary commissions on return to Army duty:—(May 15) T. R. Baber, 2nd Lt., Mon. R. (T.A.); (June 3) A. L. King-Harman, 2nd Lt., R.A.; (June 23) N. F. Chance, 2nd Lt., R. Ir. Fus.; (June 26) D. S. Sutcliffe, 2nd Lt., Seaforth.

Errata.

In the Gazette of June 11, 1940. Notification concerning P/O. Charles Trevor Davis (43614). *For* May 12, 1939, *read* May 12, 1940.

In the Gazette of July 16, 1940. Notifications concerning the undermentioned Flight Sergeants should have appeared under the heading "R.A.F." instead of "R.A.F.V.R.," and their personal numbers as Pilot Officers on probation are as now stated: M. A. Phillips (44259), R. F. Hunter (44260), E. A. Jewiss (44261), T. W. Newbould (44262), J. R. Cooksey (44263), A. E. Garrod (44264), R. J. Mansfield (44265).

In the Gazette of July 23. Notification concerning Flt./Sgt. K. S. Smith (82499) should have appeared under the heading "R.A.F.V.R." instead of "R.A.F.," and his personal number as Pilot Officer on probation is as now stated.

Technical Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers on probation:—Warrant Officers: (May 18, Sen. March 14) J. McKay, J. Buckley, A. V. Tarlton, M.M.; (July 19, Sen. May 9) W. G. Ahern; (July 25, Sen. March 14) R. J. V. Hadley; (July 26, Sen. March 14) F. B. Scrutton; (July 26, Sen. June 20) D. C. Sturrock.

W/O. P. C. Bevis is granted a permanent commission as Flying Officer on probation (July 3, Sen. June 12, 1939).

The undermentioned Flying Officers on probation are confirmed in their appointments:—(June 12) J. Balshaw, P. Honey, S. V. Vaizey, L. T. Card; (June 19) R. S. Robertson, J. A. Bennett, A. W. Alberry; (June 23) T. J. W. S. Pearce, C. J. F. McRae, P. H. Wood, A. C. Howell, R. W. Ackerman, R. Robinson; (July 12) J. B. Hards, L. Scullard, J. H. J. Williams; (July 27) E. S. Leary, G. J. Downs; (Aug. 2) E. G. Cheeseman.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(July 1, Sen. May 18) A. Marks; (July 15, Sen. May 18) A. G. Williams; (July 15, Sen. July 15) A. E. Hester; (August 2, Sen. May 18) W. Moore.

SERVICE AVIATION (CONTINUED)

Administrative and Special Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers on probation:—Warrant Officers: (May 18, Sen. March 7) W. H. Moyles; (May 22, Sen. March 7) A. Smith; (July 15, Sen. July 10) E. J. Ware; (July 23, Sen. July 15) J. Braithwaite, C. H. Palmer; (July 24, Sen. July 15) W. W. Watson; (July 31, Sen. May 2) G. W. Lombardi, M.M.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Flight Sergeants: (July 22, Sen. July 3) C. E. Mitchell; (July 22, Sen. July 12) J. M. Rowe; (July 23, Sen. July 12) G. F. Rogers; (July 26, Sen. July 12) R. J. Millington. Sergeant: (July 19, Sen. April 25) G. A. Potter.

Equipment Branch.

W/O. L. H. Watson is granted a commission for the duration of hostilities as Flying Officer on probation. (July 23, Sen. March 21.)

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation (Sen. July 10):—Warrant Officers: (July 19) R. E. Walkerdine; (July 22) J. T. Cramb, F. Martin. Temporary Flight Sergeant: (July 18) L. H. Palmer.

The undermentioned Pilot Officers on probation are confirmed in their appointments May 1, and promoted to the rank of Flying Officer. (July 31) J. E. Butland, G. E. J. Horan.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(May 1) B. B. Johnson; (July 31) W. A. Thomas, J. G. Geary, R. D. G. White, N. W. Kearon, L. Webley; (August 1) L. H. Clemas

Accountant Branch.

Flt./Sgt. N. Gibson is granted a commission for the duration of hostilities as Pilot Officer on probation. (July 23, Sen. June 6.)

F/O. on probation G. S. J. Pratt is confirmed in his appointment. (March 27.)

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(April 17) J. A. Bryden, F. D. Holmes, R. R. Jack, P. Raby, S. C. Tapley; (June 10) H. Bamforth.

P/O. on probation S. E. D. Mills is confirmed in his appointment and promoted to the rank of Flying Officer. (June 10.)

The undermentioned Pilot Officers on probation are confirmed in their appointments June 10, 1940, and promoted to the rank of Flying Officer (July 31):—D. A. Birkett, R. H. Bradley, R. P. Breen, J. Buckley, J. E. Campbell, J. Farley, W. K. G. Nicholls.

F/O. A. F. B. Waller is promoted to the rank of Flight Lieutenant. (August 2, Sen. June 14.)

Medical Branch.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant. (June 5, 1940, Sen. June 5, 1939):—J. D. Jones, M.R.C.S., L.R.C.P.; F. Summers, M.R.C.S., L.R.C.P., M.B., B.S.

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—(September 3, 1939) R. H. C. Taylor, J. K. Flower.

F/O. H. M. Samuelson is transferred to the Technical Branch. (April 24.) (Substituted for notification in the Gazette of May 28, and notification under the heading "Administrative and Special Duties Branch" in the Gazette of July 2.

Sqn. Ldr. H. R. Kavanagh, M.B.E., relinquishes his commission in class CC on appointment to a commission in the R.A.F.V.R. (July 30.)

Flt. Lt. W. J. Pearson relinquishes his commission on account of ill-health. (August 1.)

Royal Air Force Volunteer Reserve

General Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation (July 20):—(July 25) K. M. Sclanders. Sergeants: (April 1) I. D. Hawken; (May 25, Sen. April 25) L. A. Bale; (June 18) A. C. R. McLure; (June 22) A. M. Wodehouse; (June 29) G. E. Moon. A. J. Henderson, J. G. Curley, E. V. Smith, H. Steel; (July 6) R. Baker, D. L. R. Smith, E. W. Wiseman; (July 15) W. D. Mackenzie; (July 15, Sen. July 11) E. D. Glaser, D. A. Green, J. Henderson; (July 20) J. D. Gardner; (July 20, Sen. July 11) C. J. Ginder. Leading Aircraftman: (June 30) L. J. Lane.

The undermentioned are granted commissions for the duration of hostilities as Acting Pilot Officers on probation:—(July 19) L. W. Abbiss, R. D. Allen, S. Boxall, E. M. Collard, T. G. Corner, A. W. Dawson, K. G. Elliott, J. G. C. Hepburn, W. E. Laceby, C. J. Myers, G. d'E. T. Skipwith; (July 20) F. W. Bailey, C. A. H. Collier, S. A. Colvin, C. H. Duncan, H. H. J. Hobday, P. W. Lambert, F. J. Leslie, H. Mann, E. S. H. Morris, G. S. E. Morris, C. A. Patten, R. A. Pinchen, R. Rawlins, L. E. Ticehurst, N. Whyte; (July 21) E. S. Dawson, J. E. Johnston, G. C. Muir, R. W. B. Rainford, D. Woodcock, G. F. Woolhouse; (July 22) R. K. Crowther, G. H. Duncan, J. C. L. Hanmer-Strudwick, H. B. Jones, R. E. H. Nowell.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(May 15) N. J. M. Barry; (July 17) W. E. Frutiger.

The commission of Act. P/O. on probation A. S. Carter is terminated on cessation of duty. (July 20.)

Errata.

In the Gazette of October 31, 1939, Notification concerning Pilot Officers G. C. Halley and H. S. Ford. *For* October 16, 1939, *read* October 15, 1939.

In the Gazette of March 12. Notification concerning R. D. Hanbury. *For* A.P/O. on probation *read* P/O. on probation.

In the Gazette of May 7. *For* R. J. B. Pearce *read* R. J. B. Pearse.

In the Gazette of May 28. *For* L.A/C. F. R. Goodard, *read* L.A/C. F. R. Goddard.

In the Gazette of June 4. *For* Anthony Charles Geary, *read* Arthur Charles Geary.

In the Gazette of July 23. *For* Mark Anthony Lacayo, *read* Mark Antony Lacayo.

Technical Branch.

Cpl. J. C. Coombes is granted a commission for the duration of hostilities as Pilot Officer on probation (July 22, Sen. July 1).

Balloon Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Cpls.: (July 3, Sen. June 25) C. C. W. Rodd; (July 10, Sen. June 27) H. Muslin; (July 14, Sen. June 24) W. E. Stephens; (July 22, Sen. June 27) W. E. R. Hendry; Leading Aircraftman: (July 16, Sen. June 27) T. Brown, Aircraftmen, 1st Class: (July 5, Sen. June 27) L. A. Lane; (July 10, Sen. June 27) J. H. P. Briggs; (July 16, Sen. June 27) J. R. Thomlinson. A/C 1 K. M. Buckley is granted a commission for the duration of hostilities as Act. Pilot Officer on probation (July 21, Sen. July 17).

Administrative and Special Duties Branch.

The undermentioned are granted commissions as Flight Lieutenants:—(July 29) Capt. C. M. G. Luxmore, R.N. (Ret.); (July 30, Sen. June 5, 1939) Maj. H. R. Kavanagh, M.B.E.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—(May 27) L. Wilson; (June 5) W. M. Brown, A. H. C. Bruce; (June 6) J. Williams; (June 10) G. W. Wentworth; (June 15) G. M. Robertson; (June 15) H. C. W. Sharp, A. W. Barnett; (June 24) F. H. Bowden; (June 26) E. T. H. Horne, F. H. Gale, G. Lord, J. C. Warren; (June 27) H. Ames, S. Danby, H. U. Everist, L. H. Jones, W. E. Ladd, E. Stevenson, F. F. Suffolk, F. T. Walker; (June 28) T. F. Ball, F. K. Hensley, C. Arnold, H. Cowell, C. A. Dingle, A. L. Gilmore, P. R. Hinton, A. Hood, G. H. Long, G. Romilly, C. L. Smith; (June 29) J. H. Barclay, E. H. Barton, W. T. Benfield, E. S. Halford, W. Houston, C. H. Kilpatrick, J. G. McIlwraith, W. Taylor, N. L. Tuckwell; (June 30) A. E. Balfour, H. E. D. Betts; (July 1) B. S. Browne, J. Carleton, L. D. Ford, R. T. Foster, G. H. Gray, G. H. Miller, H. K. Purcell, A. C. Robertson, W. C. Robertson; (July 2) A. T. Cannon, S. O. Caton, C. W. Froude, J. C. B. Longbotham, C. H. Rimington, H. A. Smart, V. Tansley, G. N. Thompson, S. A. N. Ward, J. Wrafter, T. H. Mew; (July 3) J. S. Stacey; (July 4) W. G. Cragg, D.S.O., E. J. Finch, J. E. Hardy, M. L. Lakin, E. Montague Smith, O. M. Parker; (July 5) T. W. Hay, H. D. Vaughan, B. Beach; (July 6) G. C. Rhoden, C. B. Greenhill; (July 8) E. G. Gordon-Poggi, W. Reynish; (July 9) M. M. F. Wingate, A. J. Ellis, H. F. Fenn; (July 10) J. Friend; (July 12) H. Adcock, S. R. J. Addison, D. J. Amos, F. O. Baddiley, L. R. Batten, F. G. Battersby, C. J. Boydell, J. V. Brown, J. R. M. Brunton, R. E. Burnett, D. P. Cartwright, C. W. Coaten, G. S. Corcoran, A. H. H. M. Dickie, A. G. Drayson, C. H. Dredge, L. B. Earp, A. Edwards, H. W. Endean, C. Evans, J. A. Evans, J. F. Fletcher, D. Gardiner, A. H. Glenny, W. R. Henley, K. Hitchins, A. S. Howgrave-Graham, D. S. Jewell, J. H. McG. Kelly, P. H. Kimber, G. H. C. Mackay, R. E. Miles, P. Morrell, the Hon. C. E. North, M. J. Osler, G. F. H. Page, W. J. J. Roche-Kelly, A.F.C., W. E. Sands, L. G. Scarman, G. S. Shaw, A. T. Shawcross, J. L. Sloan, G. M. Tiffen, W. W. Todd, E. F. W. Truscott, J. H. L. Trustram, G. C. S. Tydeman, H. F. Viney, R. O. Whitaker, B. B. A. Whitton, J. A. Yonge, D.F.C., S. H. Rogers; (July 14) J. C. Saxby; (July 15) D. C. L. Potter; (July 16) A. W. C. Barr, L. G. Black, A. H. Kerr, L. R. Protheroe; (July 17) C. Roebuck; (July 18) A. N. Berry, R. Woodhouse; (July 19) D. M. Anderson, J. W. A. Andrews, D. H. Bacon, W. G. Barron, J. F. K. Barton, W. D. Bates, H. B. Bourne, F. C. Bradley, G. E. Brice, H. E. Byram, A. Cairns, R. A. Collins, V. F. Cottrell, D. B. Crooke, F. L. Clark, A. Cumberbirch, A. C. Dobson, C. K. Edwards, R. A. G. Edwards, F. D. Elworthy, L. J. W. P. Fountain, B. J. Griffith, H. J. G. Hare, E. L. Hayward, H. A. Hewat, N. H. Holm, W. J. R. Humerston, B. R. Hutchinson, G. D. Johnson, H. E. Jones, J. W. Keefe, A. H. Kendall, P. G. G. Knight; G. L. Lazarus, P. R. Levy, F. E. Lord, G. E. W. Lush, R. E. Macpherson, J. A. Macqueen, P. R. Major, C. L. Malcolmson, J. D. Marvin, H. Massingham, H. B. Moore, R. T. Morison, R. W. Nash, M. W. Noel, J. B. Nutter-Myers, A. C. Phillips, H. K. Porter, F. S. Pratt, C. A. Redgrove, H. E. Reynolds, L. R. Robertson, D. G. Ross, O. F. G. Ross, R. E. Stevenson, P. J. Sykes, D. H. Tingey, L. L. Walker, R. O. G. Waterall, G. H. White, R. I. Whiteley, S. B. Wilford, R. B. Williamson, L. H. Wilson, C. G. C. Woledge, C. H. Wood; (July 20) W. T. Devereux, H. L. Nalty; (July 22) A. J. R. Adam, F. J. Ashton, G. H. Brown, R. I. L. Cameron, A. D. R. Ceroe, P. Hodgson, B. N. Mills, G. F. Morse, J. R. Purdy, J. A. McL. Russell, B. A. Smith, D. P. Thres, B. M. Walter, A. A. J. Wells, C. Winslow-Taylor; (July 23) T. E. Bangor-Jones, J. Cooke, C. H. Dixie, P. G. A. Harvey, N. L. Mellush; (July 24) H. W. L. Baartman, J. W. Baker, A. Dunbar, G. R. Hodgson, O. A. G. Jackson, E. M. Patterson, K. B. Wild; (July 25) E. Clemow, G. D. Lloyd Goslett, E. N. Partington, G. S. V. Went, G. F. Woolfe.

E. W. Bonar is granted an honorary commission as Pilot Officer (August 6).

P/O. on probation J. Rimmer is confirmed in his appointment and promoted to the rank of Flying Officer (March 17).

Hon. Sqn. Ldr. A. L. Macmillan relinquishes his honorary commission on cessation of duty (August 6).

The undermentioned Pilot Officers on probation resign their commissions:—(July 31) W. Arbuthnot Lane; (August 1) A. J. E. Behm.

Medical Branch.

The undermentioned are granted commissions for the duration of hostilities:—Flight Lieutenants: (July 15) G. T. James, M.B., B.Ch., D.P.M.; (July 23) H. A. Thomas, M.B., B.Ch., F.R.C.S. (E); H. W. Toms, B.M., B.Ch., M.R.C.S., L.R.C.P., D.P.H.; A. S. Simpson, M.B., B.S., M.R.C.S., L.R.C.P., D.P.H. Flying Officers: (July 23) R. Crawford, M.B., B.Ch., M.R.C.S., L.R.C.P.; R. Cunningham-Jones, M.R.C.S., L.R.C.P.; T. R. Davison, M.B., B.S.; G. G. Hartill, M.R.C.S., L.R.C.P.; I. W. Hockley, M.R.C.S., L.R.C.P.; J. E. Horrocks, M.B., Ch.B.; R. N. Houlding, M.B., B.S., M.R.C.S., L.R.C.P.; L. J. Jacobs, M.B., B.S.; H. J. Lillie, M.B., Ch.B.; W. W. McGrath, M.B., B.Ch.; V. E. A. Marwood, M.B., Ch.B.; D. S. Napier, M.B., Ch.B.; E. P. S. Snell, B.M., B.Ch., M.R.C.S., L.R.C.P.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant (June 13):—G. R. Gunn, M.B., Ch.B.; P. S. Clouston, M.B., Ch.B.; J. V. Macgregor, M.B., B.S., M.R.C.S., L.R.C.P.

Dental Branch.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(June 5) N. H. Hayward, L.D.S.; (July 25) N. W. Tippett, L.D.S., R.F.P.S.

Chaplains' Branch.

The undermentioned are granted commissions for the duration of hostilities with the relative rank of Squadron Leader:—(July 24) the Rev. C. L. Harrison, the Rev. R. S. Maxwell, B.A., B.Sc.; (July 27) the Rev. G. E. Sparrowe; (July 29) the Rev. H. G. Pellatt.

Auxiliary Air Force

Balloon Branch.

Sqn. Ldr. G. S. James relinquishes his commission on account of ill-health (August 10).

Medical Branch.

Flt. Lt. J. E. Howell, M.B., Ch.B., is promoted to the rank of Squadron Leader (July 9).

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(June 12) L. Stone, L.R.C.P., L.R.C.S.; (June 16) B. P. Robinson, M.B., Ch.B., F.R.C.S., M.R.C.S., L.R.C.P.; (July 3) E. O. Walker, M.B., B.Chir., M.R.C.S., L.R.C.P.; (Aug. 2) E. Llewellyn, M.B., Ch.B.

Women's Auxiliary Air Force

The undermentioned are appointed Assistant Section Officers on the dates stated:—(Aug. 1) A/CW.2 Lady J. E. Rhys Williams, D.B.E., Miss P. Clive, Mrs. I. L. C. Jourdain, Miss E. C. Towse, Mrs. G. O. Trapman; (Aug. 3) A/CW.1 Miss B. M. Apthorpe, A/CW.2 Miss J. M. Brown, A/CW.1 Miss E. M. Burren, A/CW.1 Miss P. M. Collins, A/CW.2 Mrs. J. Cooke, Cpl. Miss M. J. Disbrowe, A/CW.1 Miss M. I. Findley, A/CW.1 Mrs. M. D. Gardner, A/CW.1 Miss N. Gilbertson, A/CW.1 Miss J. M. M. Gisham, A/CW.1 Mrs. M. Harris, Sgt. Miss D. M. Hazlehurst, Cpl. Miss J. M. I. Hibberdine, Cpl. Miss E. S. Hunter, A/CW.1 Miss F. S. Ilsen, A/CW.2 Mrs. A. Lambert, A/CW.2 Mrs. E. D. Lyne, A/CW.1 Mrs. B. R. Mitford, Cpl. Miss M. F. A. Mount, A/CW.2 Miss S. M. Newman, Sgt. Miss E. M. Pegler, A/CW.1 Miss M. A. Power, A/CW. Miss E. E. Preston, Cpl. Miss C. M. Price, Cpl. Miss M. E. Ralphs, A/CW.2 Miss E. M. Reeves, A/CW.1 Miss D. M. M. Stanley-Turner, A/CW.2 Miss I. L. M. Stevenson, Sgt. Miss P. Sword, A/CW.2 Miss M. D. E. Ten Brocke, A/CW.2 Mrs. G. M. Walkden, A/CW.2 Mrs. J. A. Wardlaw, Sgt. Miss D. Warren Brown, Cpl. Miss M. Whitehurst, A/CW.2 Miss S. L. R. Wotherspoon.

The undermentioned Assistant Section Officers relinquish their appointments:—(July 20) Miss J. Broad; (August 4) Miss B. Smedley Crooke; (August 9) Mrs. J. D. Douglas.

Correction.

In our issue of August 15 an error occurred in our extract from the *London Gazette*. On page 130, column 3, all the appointments and promotions commencing from J. G. Brown, J. A. J. Davey, to Act. P/O. on probation P. B. Verver should have appeared under *General Duties Branch.*

Lord Beaverbrook: Cabinet Minister, Minister of Aircraft Production and Newspaper Proprietor.

THE INDUSTRY

H.P. Dividend

HANDLEY PAGE, LTD., have declared a final dividend of 20 per cent., tax free, on the ordinary stock. In October last a 10 per cent., less tax, interim dividend was announced, but, following the previous year's precedent, the board supplemented a less-tax interim by a tax-free final distribution. Net profits for 1939 are given at £219,478 against £190,696 for 1938.

High-duty Appointments

HIGH DUTY ALLOYS, LTD., announce that Mr. H. G. Herrington, Mr. S. Sanders and Mr. W. E. Prytherch have been elected to the Board of the Company.

Messrs. Herrington, Sanders and Prytherch occupy positions as General Manager, Personal Assistant to the Managing Director and Chief Metallurgist respectively.

Blackburn Profits

FOR the year ended March 31, Blackburn Aircraft earned a net profit of £190,144, compared with £140,301 for the previous period.

The increased revenue reflects the extended production of the Skua dive bomber for the Fleet Air Arm and other types of which no mention may be made.

The above figures are arrived at before deduction has been allowed for taxation, and since the ordinary capital is now double that for 1938-39, the reduction in dividend from 15 per cent. to 10 per cent. is easily understood.

Bristol Annual Report

THE report of the directors, to be presented to the shareholders at the Thirtieth Ordinary General Meeting, shows a strong position. Nevertheless, it should not cause the taxpayers any heartburning having regard to the magnitude of the undertaking. Net profit for the year stands at £319,975 and £9,901 has been brought forward from the previous account making a total of £329,877 available for distribution.

The five per cent. Cumulative Preference shares have already absorbed £19,500, and an interim dividend of 4 per cent. on the Ordinary shares a further £85,800. A sum of £100,000 is now transferred to general reserve; £10,727 is carried forward to the next account and the remaining £113,850 represents a final dividend on the Ordinary shares of 6 per cent.

William E. Rootes, Chairman of Rootes Securities Ltd. In addition to controlling eighteen motor manufacturing and distributing companies, he is President of the Society of Motor Manufacturers and Traders, Chairman of the Motor Group under the Board of Trade, and Chairman of the Aero Engine "Shadow" Group.

Co-operation

BY mutual agreement between the two companies, Mr. J. R. Standring, General Works Manager of The de Havilland Aircraft Company, Limited, Stag Lane, has accepted a temporary appointment as Director of Production with D. Napier and Son, Limited.

Whilst carrying out these duties Mr. Standring will cease to act as General Works Manager at Stag Lane, but his services will, nevertheless, be available to the de Havilland Company in a consultative capacity.

NEW COMPANY

MARENDAZ-BOWMAN TRANSMISSIONS, LTD. Private company. Registered August 14. Capital £200 in 1,000 5 per cent cumulative preference and 1,000 ordinary shares of 2s. each. Objects: To carry on the business of manufacturers, letters on hire, purchasers and repairers of motor cars, motor and aeroplane engines, motor cycles, motor bodies, sidecars, airships, etc. The directors are: Donald M. K. Marendaz (permanent governing director), The Manor House, Little Tring, Herts (director of Bedford School of Flying, Ltd., and General Airports Corporation, Ltd.); Hugh Bowman, 5, Beaconsfield Road, St. Albans, Herts, instrument maker and engineer. Secretary: Dorothy O. Summers. Registered office: The Manor House, Little Tring, Herts.

PUBLICATIONS RECEIVED

Ranks and Uniforms of the German Army, Navy and Air Force, by Denys Erlam; 8s. 6d., Seeley Service and Co., Ltd., 196, Shaftesbury Avenue, London, W.C.1.

Metal Aircraft for the Mechanic, by J. Healey; 5s., Sir Isaac Pitman and Sons, Ltd., Parker Street, Kingsway, London, W.C.2.

Lord Nuffield: Motor magnate and aircraft manufacturer, talking to women workers in the supercharger department

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